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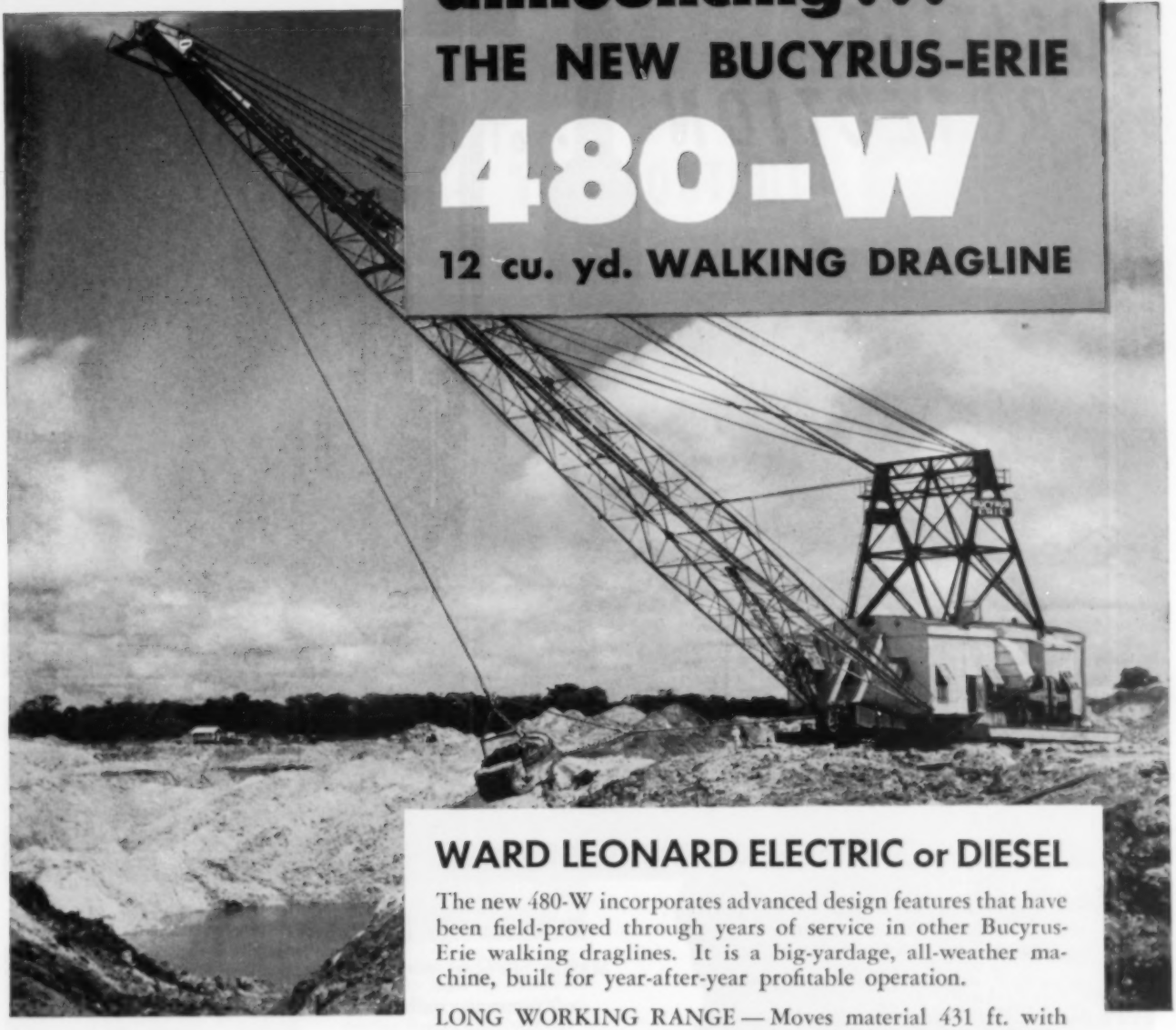

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ALL-WELDED, TUBULAR-BRACED BOOM provides plenty of strength without excess weight.

BIG OUTPUT results from dependable, year-round performance, fast moves, and rapid work cycle.

You are invited to send for additional information on how the 480-W can help you solve stripping or other long range excavating problems.

BUCYRUS ERIE

46L53C

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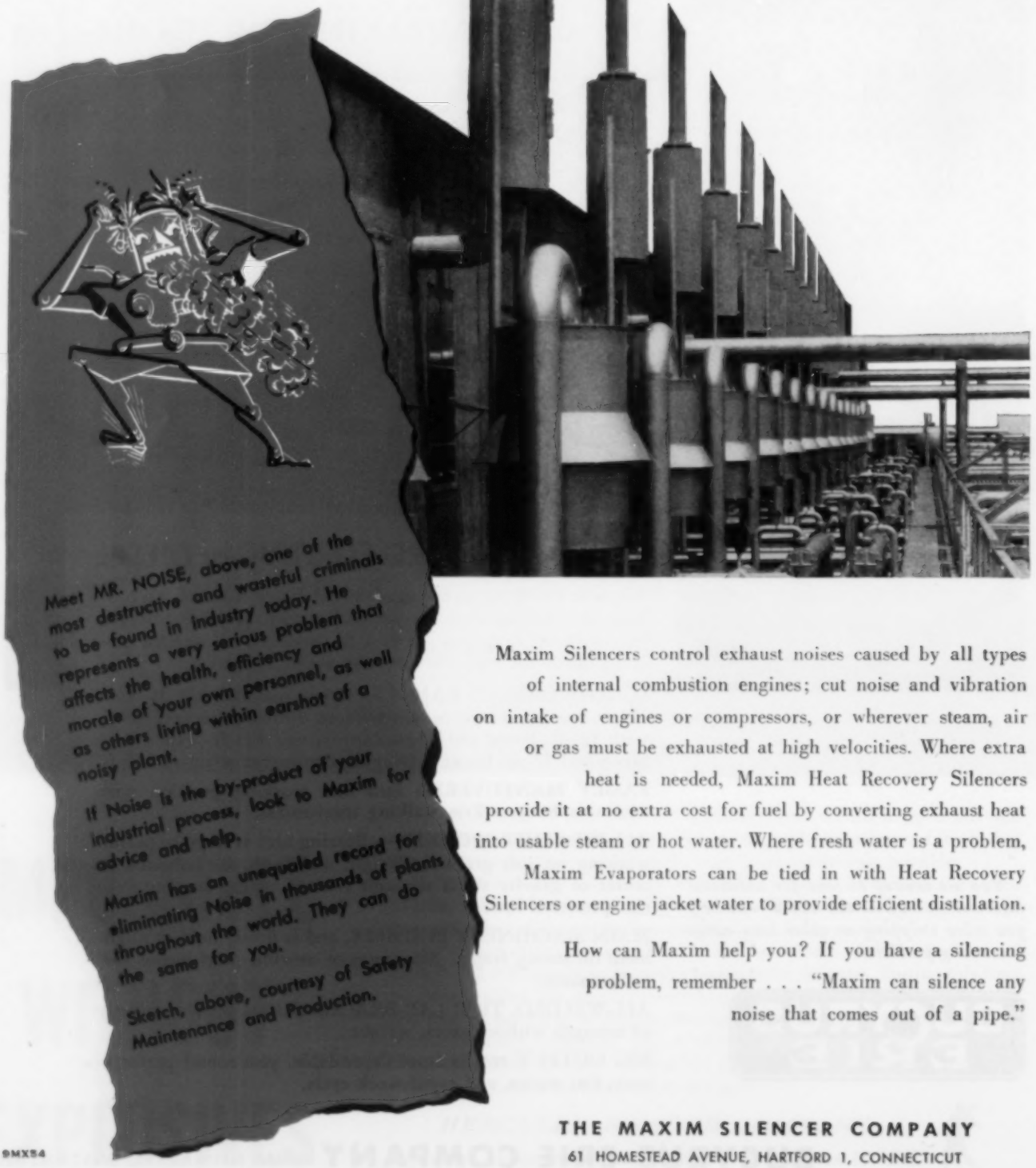

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Here a Size OOOBLC Screw Driver is used to assemble clocks. The job consists of driving Reed-Prince screws.

A Size OALC Screw Driver speeds the installation of the hood lock on an Automotive Assembly line.

46 sizes of air powered screw drivers are available with attachments to drive any type of threaded fastener.

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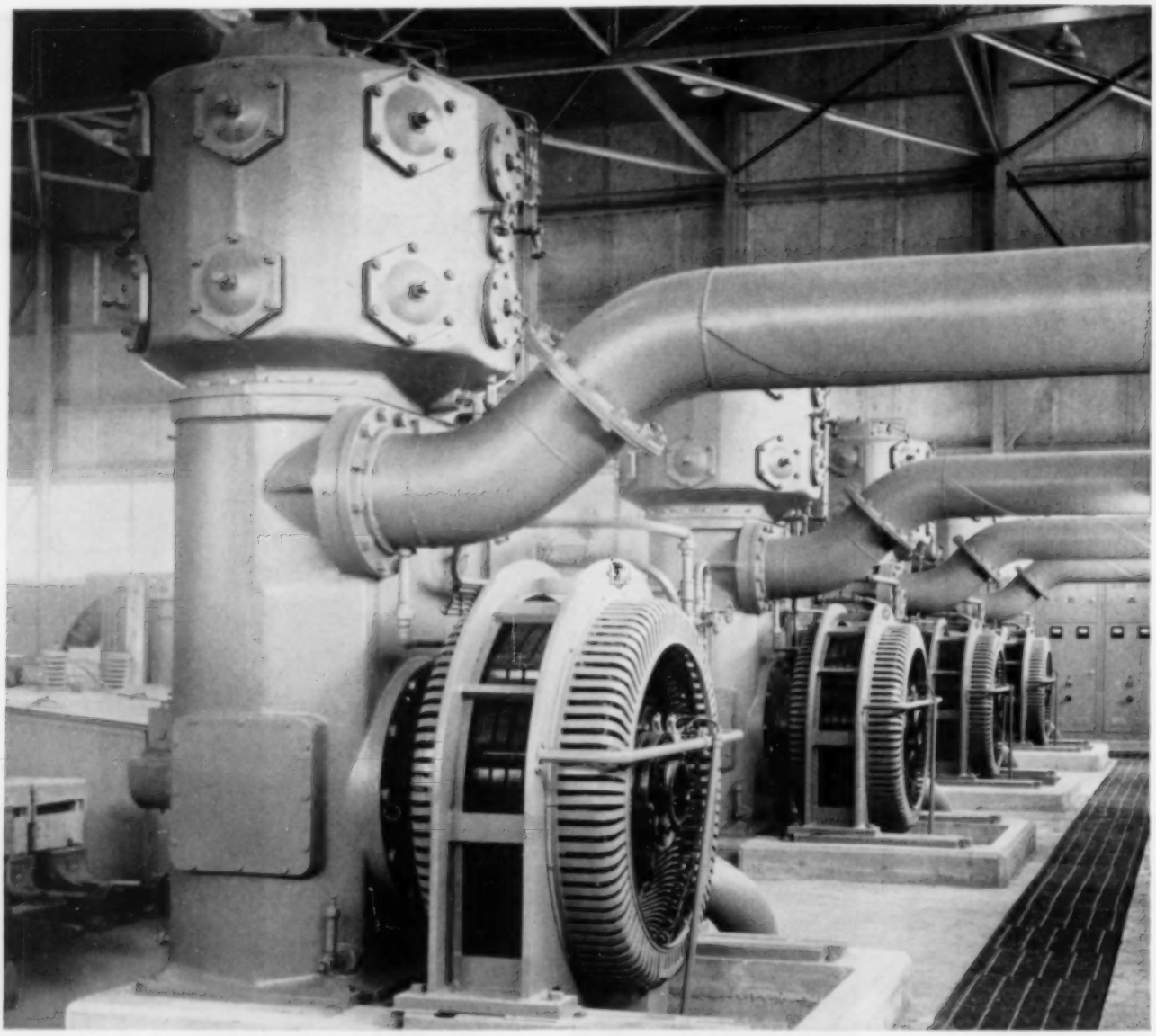

Start---Stop...Start---Stop...Start---Stop

● That's the way it is for these electric motor-driven compressors supplying air for underground mine use at The New Jersey Zinc Company Sterling Mine, Ogdensburg, New Jersey. Four 350 hp, 1.0 power factor, 450 rpm E-M Engine-Type Synchronous Motors, shown above, drive four-stage air compressors which supply air for tools and other mine operations.

Since the air driven equipment in use at any given time may vary widely, the compressors are called on to operate at any of sixteen stages of loading and unloading, as selected by a specially designed sequence control panel. This means repeated starts and stops day after day, putting unusual stress on the motor windings.

E-M engineers designed these motors for rugged starting duty. The stator coils are wound and lashed with extra strength and the starting cage windings have high capacity to withstand heavy repeated starting stresses.

And here's why these E-M Motors provide a most economical, reliable, trouble-free drive for the compressors:

1. **High Efficiency,** utilizing electric power most sparingly.
2. **Power Factor Correction,** reducing power costs.
3. **Direct Connection,** simplifying installation.
4. **Simple Starting** with "CONSCIOUS" CONTROL, through E-M "Hi-Fuse" Control with Polarized Field-Frequency System.

For specific information on how E-M Synchronous Motors can help you get top performance from large compressors, get in touch with your nearest E-M sales engineer. Write for E-M Synchronizer No. 32 on air compressor drives.

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Specialists in making motors do **EXACTLY WHAT YOU WANT THEM TO**

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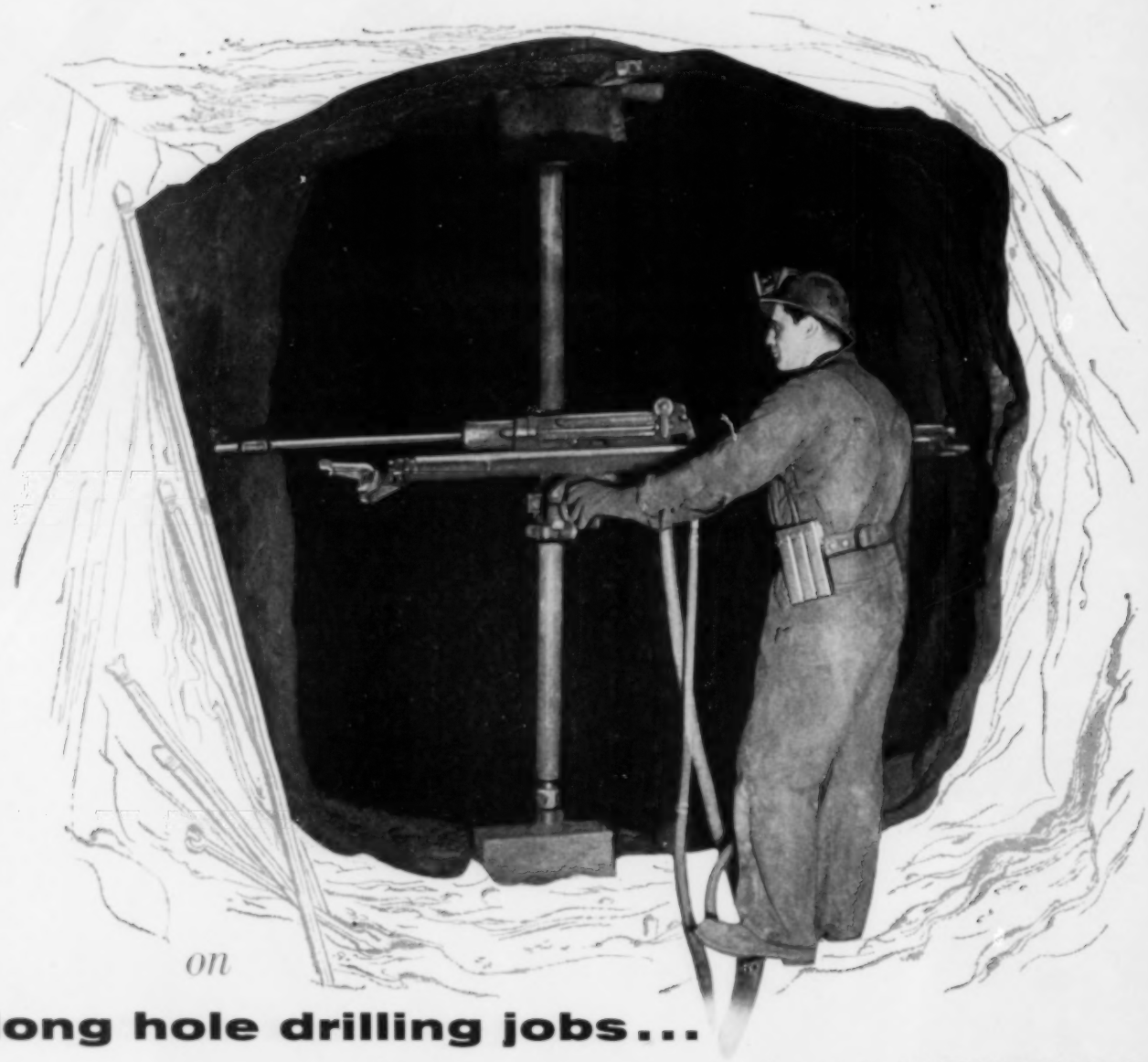
The block shown in the picture, a dozen tons of particularly fine white marble, was photographed emerging from one of the company quarries near Tate, Ga. This handling job involved a lift of 175 ft, and the hoisting was done by a stiffleg derrick equipped with sound, dependable Bethlehem wire rope. Here, as always, the Bethlehem rope met every demand with plenty to spare, for it is a product made to take such loads in stride.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

MINING • CONSTRUCTION • PETROLEUM • EXCAVATING • QUARRYING • LOGGING • MANUFACTURING



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long hole drilling jobs...

get more footage per man-shift with CRUCIBLE

CA DOUBLE DIAMOND *Alloy Hollow Drill Rods*

Tungsten-carbide bits and heavy-duty rock drills have made deep-hole drilling possible. But just as important are the sectional steel rods that go between.

You can rely on Crucible's *CA Double Diamond* Alloy Hollow Drill rods to take the roughest jobs in stride . . . with less rod breakage . . . fewer lost bits. That's because they are manufactured to tool steel specifications, by Crucible — the leading producer of special purpose steels.

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For longer drill life and lower operating costs on your next long hole job, specify Crucible *CA Double Diamond* Alloy Hollow Drill Rods.

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54 years of Fine steelmaking **HOLLOW DRILL RODS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MAX-EL • SPECIAL PURPOSE STEELS

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Eimco Loaders handle the hard abrasive ore at the rate of 2 tons per minute. Ore weighs as much as 7 to 8 cubic feet per ton.

16 TO 18 TONS PER MAN SHIFT

Yes! 16 to 18 tons per man shift — including everybody on the payroll — are being loaded in hard abrasive ores with Eimco loaders in a drawpoint loading system.

Many other companies are studying their mine development programs to adopt this most efficient method of lowering costs and increasing tonnage.

Eimco will be happy to provide a group of sketches made at different properties to show what has been done in different mines.

The use of the Eimco loader in drawpoints speeds up development time, eliminates the expense of timbered chutes and grizzly level development work, saves on powder and increases the safety of operation.

Eimco Engineers will be glad to discuss mechanical loading from drawpoints with no obligation to you. Write The Eimco Corp., P, O. Box 300, Salt Lake City 10, Utah.

B-10

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Salt Lake City, Utah, U.S.A.

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You Can't Beat An Eimco

Full Year's Service in Israel Gives Further Proof of GYRO-FLO Dependability

This Ingersoll-Rand 210 cfm GYRO-FLO compressor, shown here on a paving job in Tel-Aviv, Israel, has been in steady service for a year with no attention other than routine inspection and fueling.

Thousands of miles from the factory, this 210 cfm GYRO-FLO has required no maintenance other than on-the-job routine servicing

Wherever in the world GYRO-FLO compressors are used, the reports are pretty much the same. It's the most maintenance-free portable unit ever applied on any job.

That's because the GYRO-FLO rotary compressor is the last word in mechanical simplicity, stamina and dependability. It has no pistons, rings, rods, valves or clutches to wear out, adjust or replace. Since discharge temperatures are below 200°F, air hoses last longer, too. And by maintaining constant 100 psi pressure, the GYRO-FLO assures maximum efficiency of your air-power equipment.

GYRO-FLO portable compressors are now available in 105, 210, 315 and 600 cfm sizes, powered by GM diesel or Continental Red Seal gasoline engines. Whatever your portable air power requirements, chances are you can do the job faster and at lower over-all cost with a GYRO-FLO. Ask your Ingersoll-Rand distributor or branch office for complete information.

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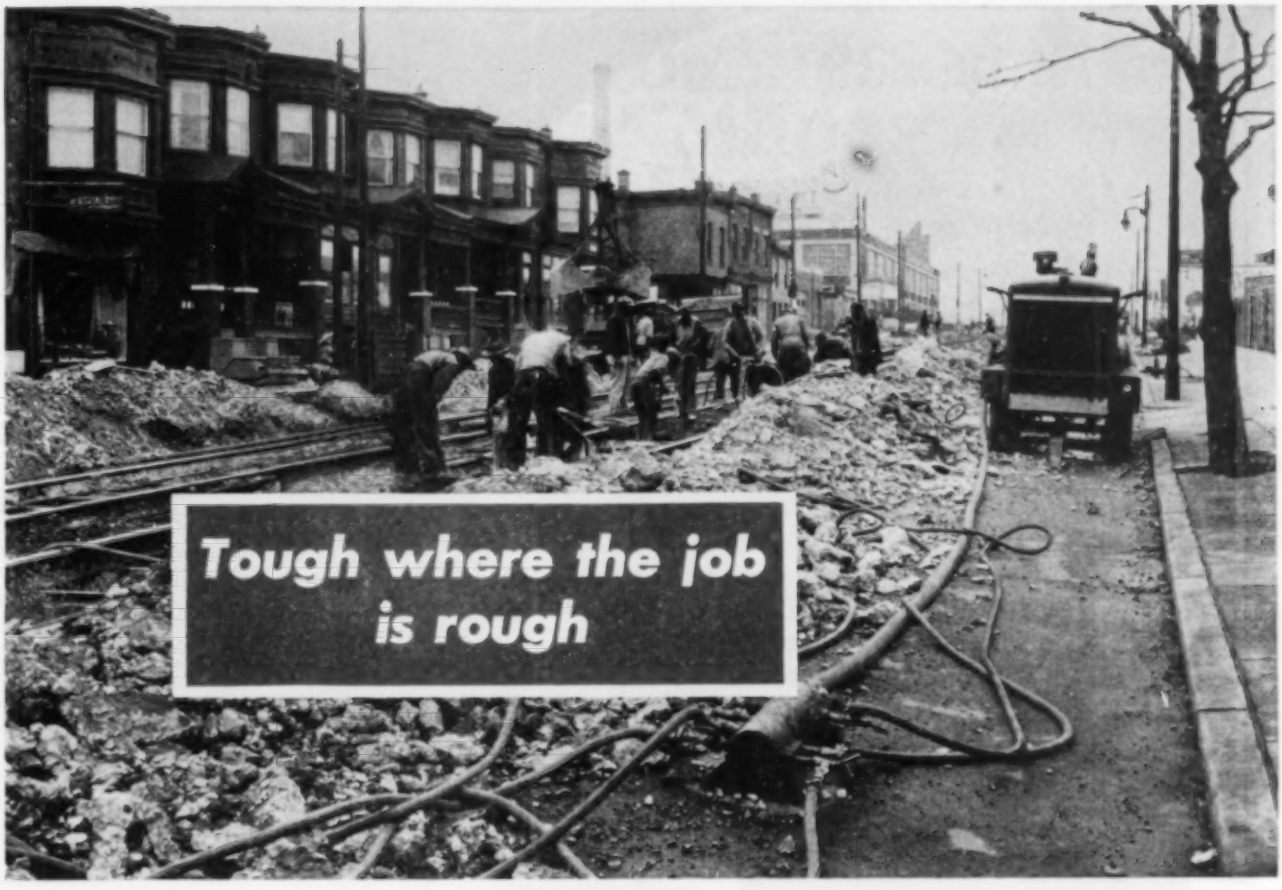

Compressor hose with tube and cover of NEOPRENE withstands brutal punishment in track maintenance

Pneumatic paving breakers take a terrific beating on track repair jobs—and so do the air hoses that feed them. These hoses are yanked from under heavy pieces of rubble and twisted around sharp corners of sun-baked pavement—rough service for any hose cover. And hot, oil-laden air continually threatens the hose tube. Yet here's a compressor hose that's built to stand up to all this punishment. It's made inside and out with rugged Du Pont neoprene.

THE COVER OF NEOPRENE is tough and durable . . . resists abrasion, cutting and chipping throughout its long life. And, because neoprene can withstand the deteriorating effects of sunlight, heat and weathering, the fabric reinforcement receives maximum protection.

THE NEOPRENE TUBE won't go to pieces when exposed to hot lubricating oil in the air stream. No crumbled particles are carried along to clog vital tool parts. And neoprene's toughness and flexibility assure long, trouble-free service under the most adverse conditions.

DU PONT SUPPLIES neoprene to hose manufacturers who use it in their top-quality lines. Ask your supplier about all kinds of hose with tube and cover of neoprene. He'll be glad to show you how it's built for rugged service.

FREE! **THE NEOPRENE NOTEBOOK**

Each issue brings you new, unusual applications of neoprene . . . new products . . . interesting stories. Send in the coupon below to get on the mailing list.

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Always the top weld grinding wheels, the new Norton Reinforced Hub Wheels — the Rigid BD and the Semi-Flexible BFR — now accentuate the profit-building "Touch of Gold" with greatly improved performance.

NOW...better than ever!

New improvements in Norton BD and BFR wheels for weld grinding

add greater value to the "TOUCH of GOLD"

The story behind the new Norton BD (Rigid) and new BFR (Semi-Flexible) Reinforced Hub Wheels is a striking example of Norton's never-ending product development.

Already top performers over the widest range of weld grinding jobs, these two popular wheels have been re-designed for even greater popularity. Advantages like the following tell you why:

The rigid BD wheel. A new outside layer of cutting material enables the BD wheel to cut on both sides — and to start cutting the instant it touches the work, eliminating the need for "breaking-in." In addition, increased strength and durability and faster cutting action make it the ideal weld grinding wheel for heavy stock removal. It is also excellent for notching gates and risers on castings.

The semi-flexible BFR. New construction provides greater durability, for longer service life, plus faster cutting rates. Other features for stepped-up performance include: more uniform grinding action from wheel to wheel and lot to lot; stronger bonding and improved cutting-off action. Combining fast cutting with safety, the BFR is unequalled for your lighter weld grinding applications.

This new "Touch of Gold" is job-proved

In field test after field test, these stronger, faster-cutting BD and BFR wheels have outlasted and outperformed the best that competition can offer. So, once again you have the famous Norton "Touch of Gold" in action — producing better results and cutting costs in the grinding jobs *you're* doing right now. For complete facts, see your Norton Distributor. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed in your classified phone directory under "Grinding Wheels." *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

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NORTON

ABRASIVES

Making better products... to make other products better

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ON THE COVER

OUR cover picture shows the scene of a neat piece of construction tailoring on the New York Thruway. The camera was looking along the line of the expressway, across a low area and toward a hill where an 80-foot cut was being made. Nearing completion in the foreground was a concrete tunnel through which Route 81 will be shunted on a grade of 7.75 percent. The structure is 36 feet wide at the base and has walls 2 feet thick. Its top will be buried under 33 feet of broken rock when a 250,000-cubic-yard fill is completed there. Savin Construction Company is the contractor.

•

IN THIS ISSUE

FROM where we prepare and print this magazine, it is only a short distance to the "Pennsylvania Dutch" country. Cross the Delaware River and drive 17 miles to Allentown and you are in it. There you can listen to radio programs in the Pennsylvania Dutch dialect, and it is even claimed that there are Negroes who speak it. You can also meet such citizens as "Pumpernickel Bill," who, among other things, promotes a mass excursion to New York and up the Hudson River once a year. Living on the fringe of such an area has led, inevitably, to the article that starts out this issue.

•

ANOTHER article deals with air-powered clutches and brakes, and the enormous underground drilling and excavating jobs now nearing completion on the Alcan Project in British Columbia are further described and illustrated.

CORRECTION

OMISSION of a "y" from a word in this column last month made the description of our January cover picture sound a little foolish. The record-size underground powerhouse excavation at Kemano, B.C., is actually 80 feet wide instead of the eight that we made it.

AUTHOR HONORED

CHARLES R. WALTERS, district engineer for the New York State Department of Public Works at Buffalo, has received the 1954 Roy W. Crum award for distinguished service from the Highway Research Board in recognition of his numerous activities and studies dealing with highway matters and conducted outside his regular duties. Mr. Walters wrote an article for our February, 1952, issue on a method of cleaning hollow bridge piles with compressed air as carried out under his direction in building a 1030-foot structure east of Buffalo.

Compressed Air Magazine

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ANNA M. HOFFMANN, *Associate Editor* J. J. KATARBA, *Business Mgr.*
J. C. PIERCE, *Assistant Editor* FRANCIS HARTMAN, *Circulation Mgr.*
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D. Y. MARSHALL, Europe, 243 Upper Thames St., London, E. C. 4.
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The Pennsylvania Dutch

Something About the Industries and Arts of These Sturdy People

Jane S. Muller

TRADITIONALLY PENNSYLVANIA DUTCH

The pictures on these two pages were among a series that was used to illustrate newspaper advertisements for Old Reading Beer brewed in Reading, Pa. The drawings are by Edward C. Smith and were made for the Ted Black advertising agency in Reading. This one shows a basketmaker, seated at his specially designed bench, weaving well-soaked strips of wood while a visitor watches.

INHABITANTS of the Pennsylvania Dutch country, roughly a half-moon shaped area north and west of Philadelphia, have aroused friendly curiosity since the automobile made the region readily accessible. Among the earliest settlers in this nation, the Pennsylvania Dutch always have been found to be hospitable, hard-working, sturdy and possessed of a twinkling sense of humor. Behind the barrier of their dialect, which is still spoken regularly in small villages and often heard in larger communities such as Lancaster, Reading and Lebanon, they have maintained their distinctive character which, through the years, has resisted outside influences.

Germans from the Palatinate and immigrants from Switzerland, who had settled in North America late in the seventeenth century at the behest of William Penn, were followed by waves of countrymen fleeing from religious and political disturbances in their homelands. While much has been written about their thrift and industry, the extent of their diligence has not been fully appreciated. Coming to a new land with almost empty hands, the Pennsylvania Dutch adapted their way of life to the raw materials they found there. Roofs over their heads, dishes for their food and tools with which to work became the basic aims of their activities. Of necessity, the industrious immigrant first put up a log hut and then began the construction of barns and milk-, smoke- and springhouses. Frequently years elapsed before he could build the large, comfortable home he really wanted for his family.

During long, backbreaking hours every member of the household had to share in the work of making a place in the new

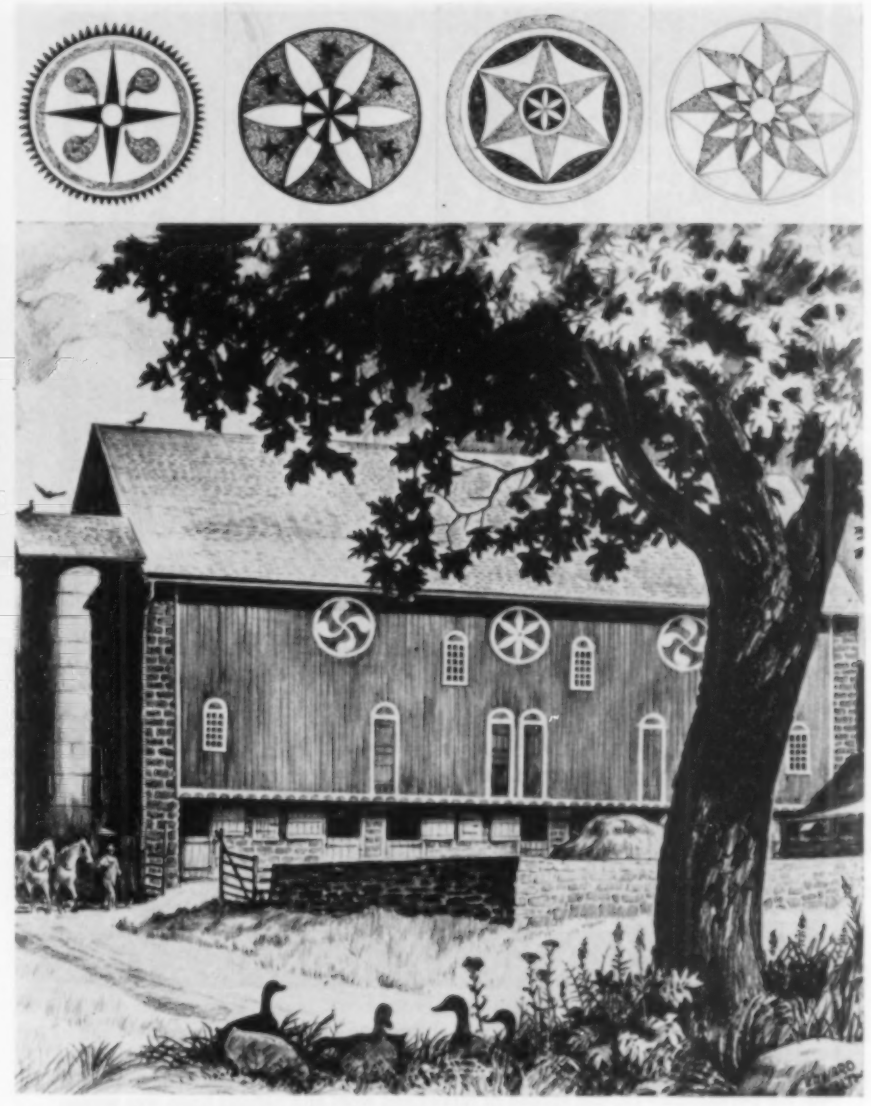
WAGON BUILDERS

Craftsmen are shown constructing the undercarriage of one of the Conestoga wagons that gained fame as "prairie schooners" during the westward migration of the nineteenth century. They were first built in the Lancaster district and designed to haul produce to market and supplies back to the farms.

The sketch at the top and those of three barns and of a plate design and coffeepot on other pages of the article are from "Folk Art of Rural Pennsylvania" by Frances Lichten. The book was published by Charles Scribner & Sons in 1946.

KENTUCKY RIFLE

This famous gun was in reality a product of Pennsylvania Dutch craftsmen. The rifles were painstakingly built to serve the needs of the pioneers in the wilderness. By 1750 thousands of them had been made.



BARN AND HEX SIGNS

The farmers prided themselves on their generous-sized, well-built barns, which they decorated with colored geometrical designs. The widespread belief that these symbols were intended to ward off evil spirits or witches (Hexen) has no foundation in fact, according to competent authorities. Similar motifs were placed on barns in the European areas from which the settlers came, and the custom was transplanted. There is no evidence that there was any superstition connected with them either abroad or here, and the hex theory does not seem to have developed until the 1920's. Typical designs are shown at the top.

land. In Europe it was then customary to detail a small lad to watch over livestock as it wandered from field to field. But in America pastures were fenced and cattle, sheep and swine were kept in barns and sties at night so that boys, even the smallest of them, could be given more important tasks. In addition to cultivating the soil, most Pennsylvania Dutch settlers had trades such as potter, blacksmith, tinsmith, gunsmith, tanner, cooper or carpenter to which they could turn when farmwork was less demanding in the colder seasons.

Few utensils were brought to this continent by the pioneers, and potters soon began to make all kinds of earthenware to meet housewives' demands. While cultivating his fields, the farmer looked for clay deposits under the turf, and in the early fall stripped off the topsoil and hauled the yellow or bluish-gray earth to his workshop where he had built a kiln. Besides the potter's wheel, which he had also constructed, little else was needed except a few wooden and wire tools, some molds, a grinding mill and fuel, so abundant in nearby woods. The mill consisted of knives set in an upright post that revolved in a stationary tub filled with clay sprinkled with water. Attached to the post was a long sweep that was turned by a horse, and as the animal walked round and round the material was ground into a pliable puttylike mass of uniform consistency. This was molded into blocks and stored in a deep cellar as a safeguard against freezing until it was required.

The commonest article fashioned by the potter was the *poi-schissel* or pie plate, a simple curved baking dish. To make a batch of these plates, the block was cut with a piece of wire into lumps which were flattened into rough sheets and piled one on top of another. A wooden roller, something like a rolling pin, served to reduce them to the desired thickness, after which they were trimmed to size by aid of a disk-cutter, laid out until partially dry and then decorated. During the rolling-cutting processes, a film of roadside dust, carefully sieved, was spread on the worktable so as to prevent the clay from sticking.

The ware was decorated by two methods—slip and sgraffito—which were used separately or in combination. The former consisted in filling a cup with liquid clay, which was poured on to the plate through one or more quills with which the cup was provided to produce a design to the potter's taste. In the case of sgraffito, the entire piece of "Pennsylvania redware" was covered with a thin coating of white clay in which the motif was etched deeply enough to disclose the red-clay base. Pottery adorned in this manner with birds, flowers, animals, human beings and conventional patterns,

WOVEN BEDCOVER

A reversible coverlet made on a Jacquard loom by a village weaver. Characteristic of the period 1820-70, this spread of turkey-red wool and natural linen was woven in two panels, which were joined down the center. When such a piece was made to order, the names of the weaver and customer and the date were put in a corner or two (lower left). This one was woven by J. Lantz in Bethlehem Township in 1842, but as the space after the word "for" is blank there was apparently no immediate purchaser for it. A closely woven and heavy cover was necessary to restrain the mountainous feather beds in general use. The materials were accumulated over a period of time, and the housewife sometimes dyed the wool. Patterns were selected from the weaver's "drafts."

as well as with legends or sentiments of one sort or another, was ordinarily used for ornamental purposes.

To return to the pie-plate disk, before it was fired and while still somewhat plastic it was pounded with a "batter" to smooth out any raised surfaces occasioned in decorating it and to reduce chipping to a minimum. Then it was slapped several times with considerable force over a mold to give it the desired form. When thoroughly dry, the beveled edge of the plate was notched with a tool called a coggle, and the glaze, a mixture of red lead and water with red clay added to thicken it, was brushed on the inner surface just before the dish was placed in the kiln. Firing softened the white slip to a pleasing yellow and brought out the rich basic brown. Many examples of this beautiful utilitarian pottery are still to be seen.

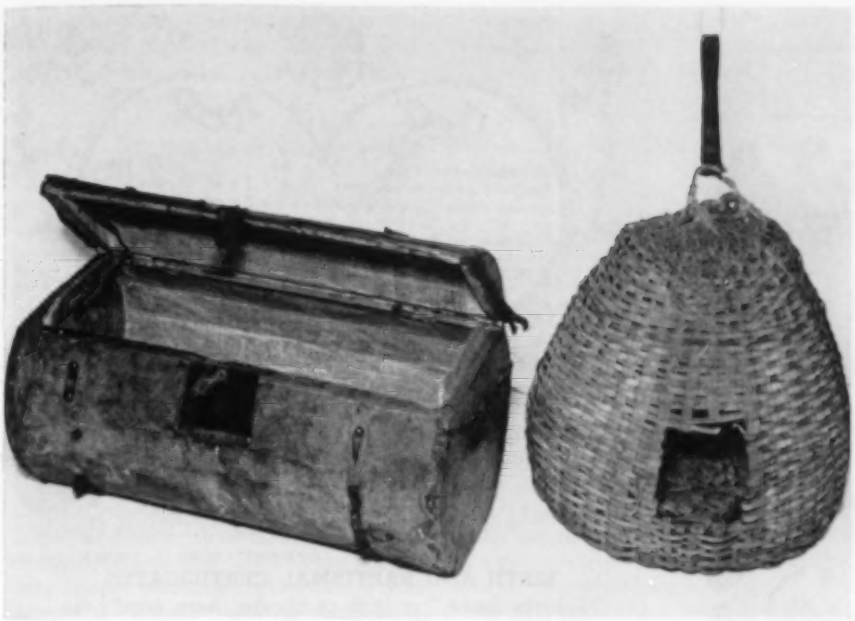
When immigration reached its crest there were already ironworks in operation in Pennsylvania. The German blacksmiths who plied their trade commanded great respect, for creating new communities from raw materials was difficult unless one had the tools, and these the smithies provided. The pioneers needed axes to clear the land on which their farm buildings were to rise, and hammers and nails and hardware. The cusp or flattened part of door-latch handles gave the blacksmith an opportunity to demonstrate his artistic bent, which found greater expression in some of the ironwork made for Conestoga wagons, which were also a product of Pennsylvania Dutch inventiveness. One of the distinctive features of these vehicles was the wrought-iron hinges and straps on the toolbox carried midway on the left side. These were often of a highly ornamental nature and designed to be not only utilitarian but to decorate the sloping lid.

Pennsylvania Dutch ironmasters probably are most noted for their cast-iron stove plates and firebacks, products of their charcoal furnaces. Designs for these were carved in relief on hickory blocks, which were impressed in sand to form molds for casting. They featured the conventional tulip and heart with familiar proverbs, or biblical scenes. Baron Stiegel, famous for his flint glass, made some remarkable stove plates at his Elizabeth Furnace. The ironworks also turned out plaques bearing house blessings or the owner's name and date to be set in the exterior walls of his home.

Iron ore, found just below the surface, presented no mining problem. With rudimentary tools the workmen dug down, never deeper than 20 feet. Along with the ore, charcoal and limestone were dumped into a 20-foot chimney built against a hillside to permit continuous feeding during the nine months of the year that the furnace was normally operated, barring breakdowns. Draft was induced by a water-powered bellows. The casting shed was in front of the furnace, and from the hearth—the sandstone base of the stack—the molten metal was run twice a day into the blackened sand molds. The iron was brittle after it had hardened and suitable only for casting. In manufacturing pots, pans and kettles, the utensils to be reproduced were used to form the sand molds

BIRD-HUNTER'S DECOY

This hand-carved piece is typical of the simple forms of woodwork with which the men occupied themselves in their rare moments of leisure.



TRUNK AND PIGEON CAGE

The small trunk, designed for stagecoach trips, was hollowed out of a log, covered with hide and bound with brass-studded leather. It is lined with sheets from the weekly "New York Enquirer" of May 27, 1847. The lock and handles betoken the blacksmith's ability to produce delicate objects from heavy metal. Dutchmen who went to pigeon shoots often took along live decoys in woven cages similar to the one shown. It was made of hickory splints and carried by a leather strap attached to the cage with a flax rope.

into which the fluid metal was ladled.

Firearms brought to America by the colonists were cumbersome, heavy things, equally lethal at both ends. Belching fire and smoke, they served to scare Indians bent upon attacking the whites but were not well adapted for pioneer life. Consuming large amounts of powder with each charge, the European rifle threw an ounce of lead in the general direction of its target. But the greatest difficulty lay in loading it. After the powder was packed behind wads in the barrel, the ball was inserted in the mouth of the bore, started down the rifling with a short rod and mallet, and then forced the remainder of the way with a heavy metal rod. It took about fifteen minutes to reload, the lead ball often being deformed in the process and resulting in deflection of the shot.

Credit for the development of the noted Kentucky rifle goes to the Pennsylvania Dutch and came about through the discovery that a smaller ball could be more easily loaded by use of a patch of buckskin or linen placed over the muzzle of the gun and could be pressed home with the aid of a hickory ramrod, thus preserving its shape, preventing scarring of the barrel, and sealing in the gases which permitted firing with greater accuracy and velocity. The chief advantage of these changes was that reloading could be accomplished in 20 to 30 seconds; in fact, sharpshooters were known to fire these weapons four or five times in one minute.

By 1750 thousands of Kentucky rifles were in use. Long and light, they were rarely of more than 45 caliber. A pound of lead produced 45 to 50 bullets, and much precious powder was saved. Made to order, the guns incorporated features desired by the purchasers, which resulted in some variation in appearance but not in performance, and all of them stood 57 to 58 inches high. The gunsmith, after heating the malleable iron in his forge, hand-welded the barrel inch by inch around an iron dowel. The bore was drilled with a hand-and-bit brace and was trued by means of a silk string; the rifling was cut by aid of a wooden die; and a grindstone was used to give the outer surface of the barrel its characteristic octagonal form. The stock was usually of curly maple. On the right side was the patch box with its ornamented brass cover, and in the cheek piece was set the 8-pointed Star of Bethlehem. The wood was then hand-rubbed with soot and oil to a rich and satiny finish. Normally, the making of a gun required a week's time from start to finish.

These were the rifles that went West with the Conestoga wagons, which originated in the Conestoga Valley, near Lancaster, named for the Indians native to the area. The vehicles provided the Pennsylvania Dutch farmer with a sturdy dependable means of getting his produce to market and hauling supplies home on the return trip. Built by carpenters, wheelwrights and blacksmiths, they became known in afteryears as "prairie schooners."

One of the identifying features of the Conestoga wagon was its white top which dipped in the middle and flared at the ends like a bonnet. Woven of flax, the cover was stretched over a dozen arched hickory boughs fitted into sockets and measured 24 feet from front to rear, while the peaks were 11 feet from the ground. Drawn together at the ends and lashed down at the sides, the "wagon cloth" protected the contents and sheltered the occupants.

Much as the keel of a boat dips toward the center, so was the bottom of the prairie schooner inclined to prevent excessive shifting of the load on steep grades. The wagon bed was usually 16 feet long and wide enough to accommodate two barrels. The rear wheels were 5 or 6 feet in diameter and had rims nearly a foot wide. Pulled by a team of six horses, the caravan had a length of approximately 60 feet. Carrying about one ton per horse, it could cover 12 or more miles a day.

SUGAR BOWL

This sgraffito specimen of Pennsylvania red ware is larger than present-day sugar bowls. The bowl was glazed almost black inside and out, but the inner surface of the cover (right) was not coated and is brick red.

COURTESY, EASTON (PA.) PUBLIC LIBRARY

BIRTH AND BAPTISMAL CERTIFICATES

"Geburtsscheine," or birth certificates, were usually the work of itinerant calligraphers. The printed designs were sometimes embellished with water colors by members of the family and sometimes by the writer. Frequently, certificates were inscribed for an entire family at one time, which explains why the date of printing on the form was often later than the birth dates written in by hand.

Just above the toolbox on the left side was the "lazy board" on which the driver could sit or stand while the conveyance was in motion. Sometimes he rode this board to operate the brake, but preferably he sat on the left-hand horse of the pair closest to the wagon. This enabled him to maneuver better against oncoming traffic and probably led to the universal American practice of keeping to the right side of the road.

Use of the Conestoga wagon inevitably led to the breeding of a suitable draft horse, and what came to be known as the Conestoga, now extinct, was one of the few races developed in America. Standing 16½ to 17½ hands high and weighing about 1600 pounds, the animal was for the most part black, but mixed breeding occasionally produced bays, dapple grays and sorrels. Though the wagon was usually pulled by six horses, the number was at times increased to eight or decreased to four, depending upon conditions, and sometimes a lead horse was employed. Backing and turning were performed by the wheel horses —the heaviest pair provided with the strongest harness—while the lightest pair served as lead horses.

As travel grew with road improvements, inns became more numerous. In the beginning, accommodations were poor and complaints about the lack of cleanliness were frequent. Most seasoned travelers carried their own bedlinen rather than chance the gifts that "mine host's" might bestow. Every hamlet had its own tavern, and the names chosen for them were usually picturesque. There was the Bird In Hand on the outskirts of Reading, the Red Lion at Red Lion, and the Cross Keys Inn at Cross Keys just outside of Doylestown. Frequently, however, the community of which it was an important part adopted the name of the inn.

The signs were mostly painted by wandering artists, who later became famous for their work in other mediums as did Gilbert Stuart, the portrait painter, who is reputed to have decorated the signboard for the King of Prussia Inn near Valley Forge. Other itinerant artists spent their summers going from farm to farm in the Pennsylvania Dutch country doing portraits of members of the family. Their usual *modus operandi* was to spend the winter months preparing canvasses, each with a faceless figure against a scenic background. In this way an artist could rapidly paint the features of a sitter on the canvas the latter had selected.

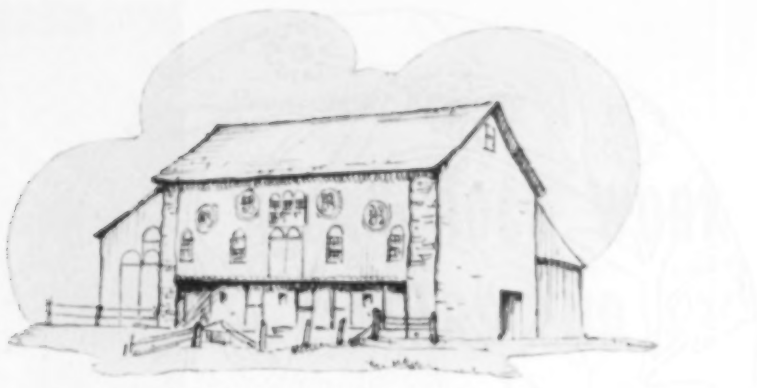
Possibly the most interesting art form in which the Pennsylvania Dutch indulged was fractur, the art of illuminated writing which, mainly in the form of *Geburtsscheine* and *Taufscheine* (birth and baptismal certificates), retained its popularity for the better part of two centuries. *Fraktur* was a sixteenth century German type closely resembling the script used by engrossers of manuscripts or documents, and it was from this that fractur derived its name, although the style was not followed closely by the Pennsylvania Dutch calligraphers. They used their imagination and did some beautiful and unusual work embellished with pictures of angels, flowers, birds and beasts. This medieval art, fostered in European monasteries, flourished at the Ephrata Cloisters in Lancaster County. There the sisters of John Conrad Beissel's Order of the Solitary illuminated manuscript hymnbooks and covered the walls with sheets of fractur executed by them on paper made for the purpose in the sect's paper mill.

Fractur was done mostly by clergymen and schoolmasters who were proud of their penmanship and ability to draw and who needed to swell their purses. But after a time, wandering craftsmen entered this field too. They inscribed

wedding, birth and baptismal certificates, *Haus-Segen* (house blessings), genealogical records in family Bibles, bookplates and bookmarkers. Richly decorated with homemade colored inks applied by quill and brush, fractur gained in extravagant hues what it lacked in draftsmanship. Later it was possible to buy printed forms which the fracturwriter filled in, adding ornamental touches of his own.

The tinsmith, or whitesmith, did not enter the scene until early in the nineteenth century, and his products were entirely unlike the mass-made toleware imported from Britain. Each piece was individual in design and was decorated by punching or pinpricking—paint or lacquer was rarely used. The whitesmith needed little in the way of equipment—a few hand tools, an anvil and a charcoal furnace sufficed him. First he cut the tin into shape, ornamented the pieces and turned the edges. Then the parts were joined by soldering. The design was drawn on and reproduced from the wrong side of each piece so that it would be in relief on the finished product. A blunt tool was used for the punching operation to make dents rather than holes. Before assembly, the decorative work was covered with a thin layer of solder to protect it, and edges and handles were reinforced with iron wire.

Lanterns, candleholders and chandeliers were perhaps the most important items made by the tinsmith. The lanterns were usually of one style, a cylinder with a conical top to which a handle was attached, and varied only in their cutout and repoussé embellishments. The faint light of a tallow dip came through openings in the cylinder, and served well

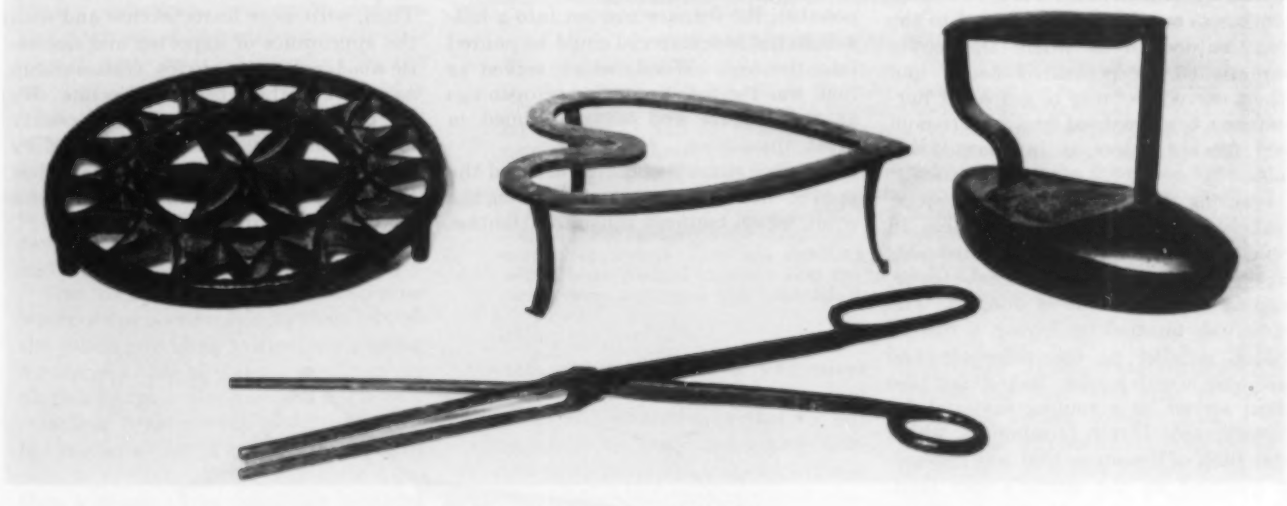


enough for early morning and late evening farm chores. The pattern changed little until low-cost glass became available. Public meeting places were generally lighted by chandeliers, consisting as a rule of eight to twelve gracefully arranged candleholders.

At Christmastime, no Pennsylvania Dutch housewife was satisfied until she had baked many, many cookies in a variety of interesting shapes, and to do that she looked to the tinsmith for the necessary facilities. For the traditional cakes she needed numerous cutters in the form of stars, halfmoons, animals, birds, flowers, etc. Those he fashioned for her, as well as other kitchen utensils, including the well-known heart-shaped colander for draining "schmier-case" (cottage cheese) from which it could be turned out perfectly molded.

As the pioneer "Dutchman" gained a stronger foothold in his adopted land and was able to build a larger, more pretentious home, he and his family felt the need of better furniture than the crude, plain household gear with which they had managed up to that point. If he happened to be a cabinetmaker, he could make it himself; if not, he ordered it from the nearest craftsman. A meticulous person, the woodworker produced articles of which both he and the farmer could be proud. While the Pennsylvania Dutch are famous for their colorfully decorated furniture, which was usually constructed of softwood such as pine, they also liked walnut and other hardwoods with their beautiful grain. The work for which the early cabinetmaker is perhaps best known today is the dower chest, then the most cherished of the household furnishings. It is this particular piece that exemplifies his flair for color and features the ever-popular tulip, along with scrolls typical of fractur work, as well as an occasional angel or unicorn.

Among the many craftsmen wandering through the Pennsylvania Dutch countryside were men who did handcarving, a more refined form of woodworking. Many examples of their art—figures of eagles, owls, barnyard fowl,



ARTICLES OF IRON

At the left is a cast-iron trivet of geometric design, probably made early in the nineteenth century. These stands were used to keep hot dishes on the table and flatirons from scorching the surfaces under them. The tripod in the center, probably of the late seventeenth or early eighteenth century, was hand-forged in the shape of a heart so popular among the Pennsylvania Dutch. The flatiron was cast, and its well-worn handle extends high above the base, which enabled the housewife to wrap it well with cloth to protect her hand. These irons came in several sizes, and each household had two or more so that spares could be heating while one was in use. The curling iron (bottom) represents one of the few concessions to personal vanity permitted the hard-working women. Used during the first quarter of the nineteenth century, it was heated on a rack before an open fire.

WORK OF POTTER AND TINSMITH

Flowers and birds were favorite forms of ornamentation. The sgraffito design at the left is in the center of a plate. Usually, the tinsmith imparted patterns to his ware by indentations, but the coffeepot is a rare example because it was decorated with a paintbrush.

squirrels, dogs and other animals—are now displayed in museums. They were intended mostly for decorative purposes, but the wood carvers also made practical things such as weather vanes, powder horns, door lintels, butter molds, rolling pins and stamps. The latter were used by millers to mark the bags in which they took their flour to market.

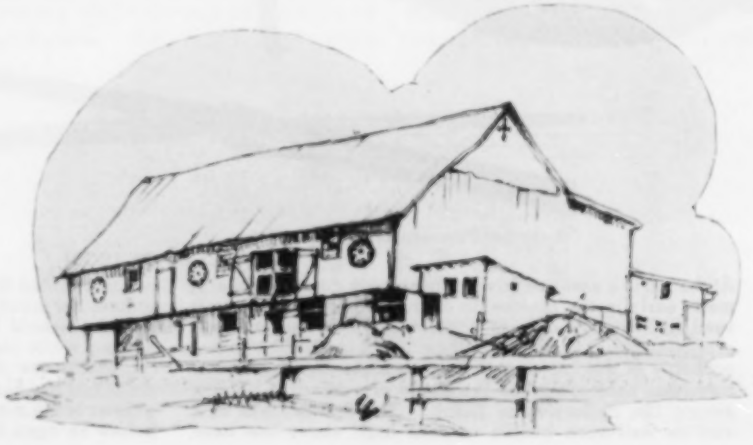
Eggs were packed for haulage in baskets made of coils of rye straw fastened to hickory splints roughly in the form of a 4-sided pyramid. The shape was thought to insure their safe arrival. The same straw was used to weave baskets of different shapes and sizes. In some dough was set to rise and carried to the great outdoor oven where the loaves were baked on preheated floors, and others served to bring in grapes at harvesttime, to store dried fruit, and to hold seed for the sower as he planted his fields.

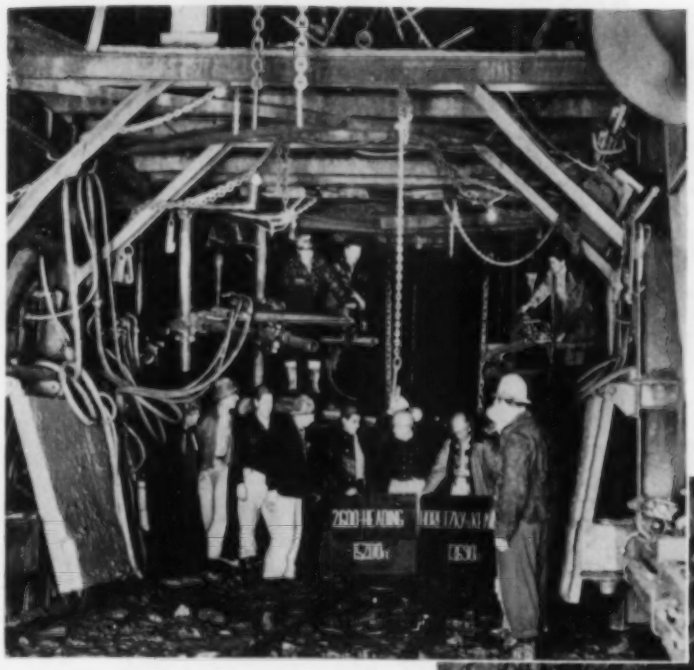
Ignoring the plentiful supply of wood available for shingles, the settlers in Penn's Woods thatched their outbuildings with bundles of rye straw, overlapping them the same as shingles. The work was finished by laying a row of thatch parallel to the ridgepole and fastening it with hooks. Baked clay tiles often served as a roofing material for Pennsylvania Dutch farmhouses, which were built of limestone that was generally quarried on the settler's own land. The stone was cut in blocks of uniform shape or laid in random style, which gave a pleasing effect especially when it began to color upon exposure. The new homes had centrally disposed chimneys, typical of the Palatinate houses which used stoves for heating rather than the open fireplaces that were favored by the early English and required end chimneys.

Mortar for building purposes was obtained from the same limestone, which the farmers burned in their own kilns, remains of many of which are still to be seen throughout the countryside. Kiln construction was a specialized trade engaged in by roving craftsmen. Wherever possible, the furnace was set into a hillside so the raw material could be poured into the top. Wood, which served as fuel, was fed into one or more openings at the bottom and was consumed in great quantities.

Hauling stone was hard work and the men of the family took turns tending the oven, which required constant attention when lime-burning was underway. Whitewash was also a product of these kilns and was used to coat the interior walls of the Pennsylvania Dutch buildings. If color was preferred to the cold white of this medium, a little indigo was added to produce a pale blue or some Venetian red to give a soft rose shade. Mixing skim milk with the colorwash prevented it from rubbing off when dry.

Modern machinery has put an end to the crafts and occupations once of paramount importance to the region. The change started gradually early in the nineteenth century when designs became simpler and handwork less prevalent. Then, with more financial ease and with the appearance of imported and domestic machine-made articles, craftmanship as practiced there began to decline. By the middle of the century, the necessity for the backbreaking labor performed by the Pennsylvania Dutch was past, but thrift and hard work remain dominant characteristics of the folk to this day.





Progress at Kemano

ALCAN ROCK WORK NEARS END

WHEN TUNNEL WAS HOLED THROUGH

The 10.1-mile, 25-foot-diameter main tunnel from Tahtsa to Kemano was driven in two sections, with an adit at Horetzky Creek near the middle providing the dividing line. The western end, Horetzky to Kemano, was holed through first, on October 23, and the final break-through, in the eastern section, came on December 2. The lower picture shows the jubilant crews at the two headings sitting on the muck pile after the October 23 junction was made; the upper one some of the staff men grouped at the meeting point, later. "Blackie" Primo, superintendent at the Kemano or 2600-heading, and Vern Bland, superintendent in the opposing heading, are holding signs indicating how much of the bore was driven by their respective crews. They are standing under the two drill carriages or jumbos which were pushed together after the muck had been cleared away. Both carriages were equipped with Ingersoll-Rand DA-35 drifter drills.

IN A little more than 25 months after they broke ground, workers on the fabulous Alcan Project in British Columbia have completed substantially all the heavy rock excavating. During that period they have drilled, shot, mucked and transported approximately 1,550,000 cubic yards, or 3½ million tons, of rock from underground openings. Slightly more than a million yards of it came out of the 10.1-mile main tunnel and the remainder from the cavernous powerhouse and four bores required for operating it.

Of the roughly 5000 men engaged on the various phases of the far-flung undertaking, about 950 have been working underground. Theirs has been a huge mining enterprise, but unlike conventional miners, they have been solely concerned with creating openings in the earth's crust and entirely uninterested in what they got out of them. The enormous tonnage they have torn loose and disposed of is in addition to the uncomputed quantity of rock that has been extracted aboveground to anchor dams, carve roads, erect transmission towers and for dozens of other purposes.

The rock drillers and their fellow workers are on schedule in their record-size job of providing hydroelectric power for the smelting of aluminum. They are playing parts in the greatest single construction project ever undertaken and the largest by far of any ever tackled by private capital. What was little more than a dream three years ago is taking tangible form. Blueprints are being rapidly transformed into realities.

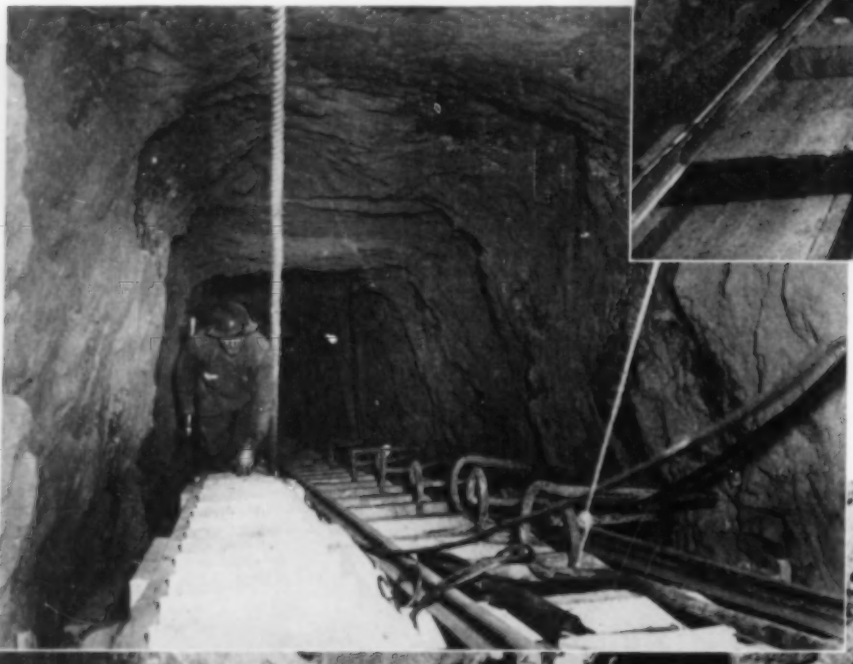
Three years ago the Aluminum Company of Canada, Limited, announced its bold plan of converting natural forces for the purpose of increasing aluminum production. In the forbidding upland area selected, 400 miles north of Vancouver and seen by few eyes, engineers had found all the elements needed to put falling water to work generating electricity—the all-important factor in making aluminum—but they required considerable adjusting.

There were high mountains and ample snowfields to feed streams, but the heaviest flow was towards the east, away from the coast. It was necessary to have the power on the coast where the raw material for aluminum could be brought in by ships. It was therefore desirable to reverse the flow, and that is the key maneuver in the Alcan Project. The water now drains through a series of finger lakes as it goes eastward. In traveling 120 miles it falls a matter of 260 feet.

The scheme called for erecting a dam on the Nechako River that would back up the water in a 120-mile reservoir and then tapping the latter by a tunnel driven westward through the upper reaches of the coast range. The dam,

LOOKING UP AND DOWN PENSTOCK RAISE

At the western end of the 10.1-mile tunnel from Lake Tahtsa the water will enter two 15-foot-diameter penstocks and drop 2600 feet to the turbines. These penstocks were driven as raises in solid rock. Each consists of two sections inclined at an angle of 48° and of a connecting horizontal jog 1000 feet below the top. In the case of the sloping sections, a pilot raise 6 feet wide by 10 feet high was first driven, and then a horizontal timber partition was put in to divide the opening into a muckway below and a manway and service compartment above. The view at the right was made looking up the manway and shows a trackway and stairway. The one just below it was taken looking down. The bottom picture shows the drill-hole pattern at a penstock heading. Note the cluster of center holes designed to form an initial opening for the other charges to break to. In some of the raises a larger, 3-inch-diameter hole was drilled for this purpose.



CRANE AIDS DRILLERS

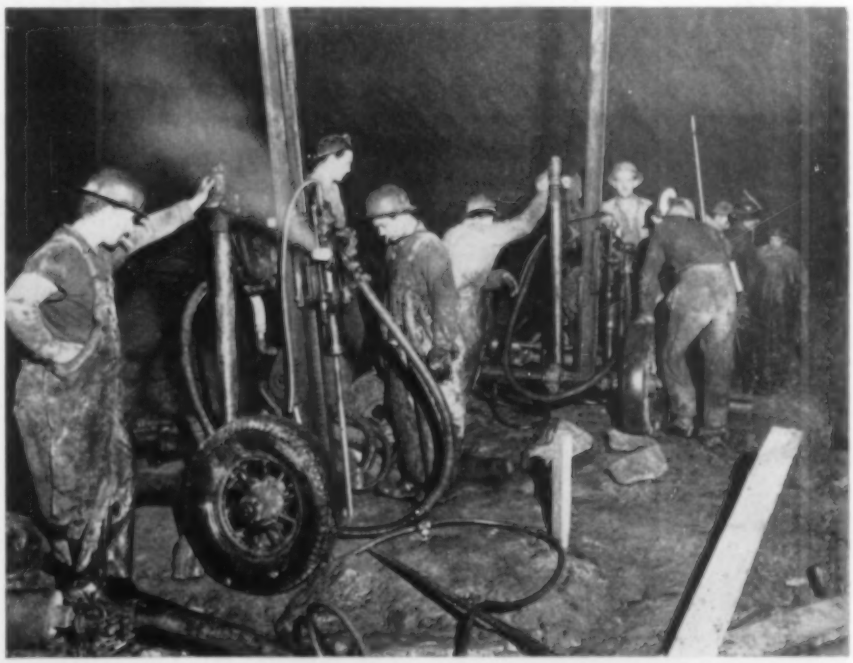
After the arched roof area of the powerhouse had been excavated and concreted, the underlying rock was taken out by drilling and shooting deep vertical holes. To facilitate trimming the walls, an open cab containing rock drills was suspended from an overhead traveling crane that was installed primarily as an aid later in erecting the heavy turbogenerators. Eight units with a total capacity of 1,120,000 hp can be accommodated.

named the Kenney, has been completed and began to fill on October 8, 1952. It is an earth-and-rock-fill structure 317 feet high and 1500 feet long at the crest. It was built by Mannix, Limited, on a subcontract from Morrison-Knudsen Company of Canada, Limited, the primary contractor for the entire undertaking.

Now the tunnel has also been excavated. On October 23, a Carset (tungsten carbide-insert) bit on the end of a drill rod propelled by an Ingersoll-Rand DA-35 drifter drill broke through the last remaining barrier of rock between the headings being advanced westward from the Horetzky adit, near the midpoint of the bore, and eastward from the Kemano end. A. O. Strandberg, project manager for the contractor, closed the switch for the final blast at 12:50 p.m. The eastbound crews had driven 15,200 feet and the westbound ones 13,690 feet—a total of 28,890 feet. At the other end of the tunnel, between Tahtsa and Horetzky, there remained about 3300 feet. Crews at two headings working toward each other accomplished the final breakthrough on December 2.

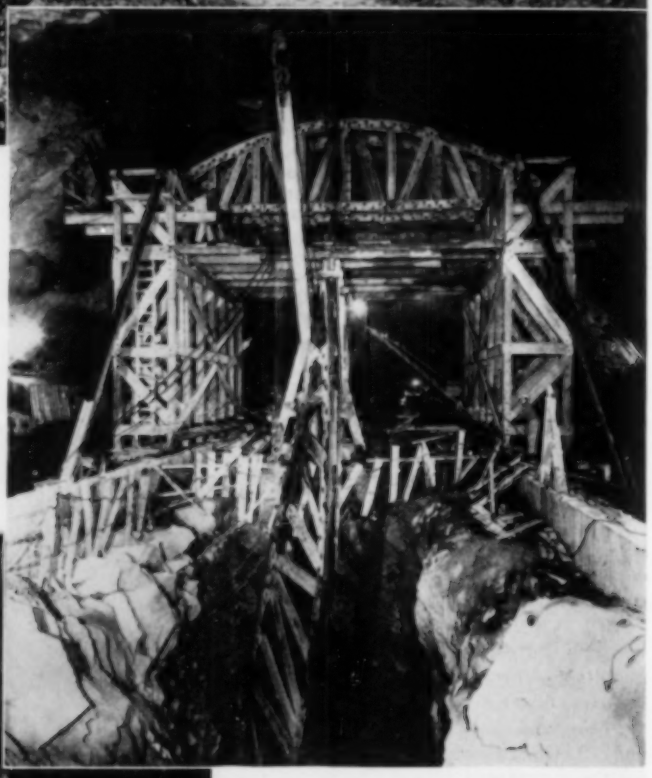
While this 25-foot-diameter opening was being punched through the complex of metamorphic rocks, the crews were staging a merry competition that resulted in breaking the progress record for a bore of this size five separate times. With DA-35 drifters, massed sixteen on a carriage and eating from 102 to 108 blast holes through the rock every round, successive marks of 248, 258, 261 and 274 feet in six working days were established. Finally, last February, the Horetzky-Kemano crews advanced 282 feet in six days and 61 feet in one day, and those performances were never surpassed.

Meanwhile, there was plenty of other



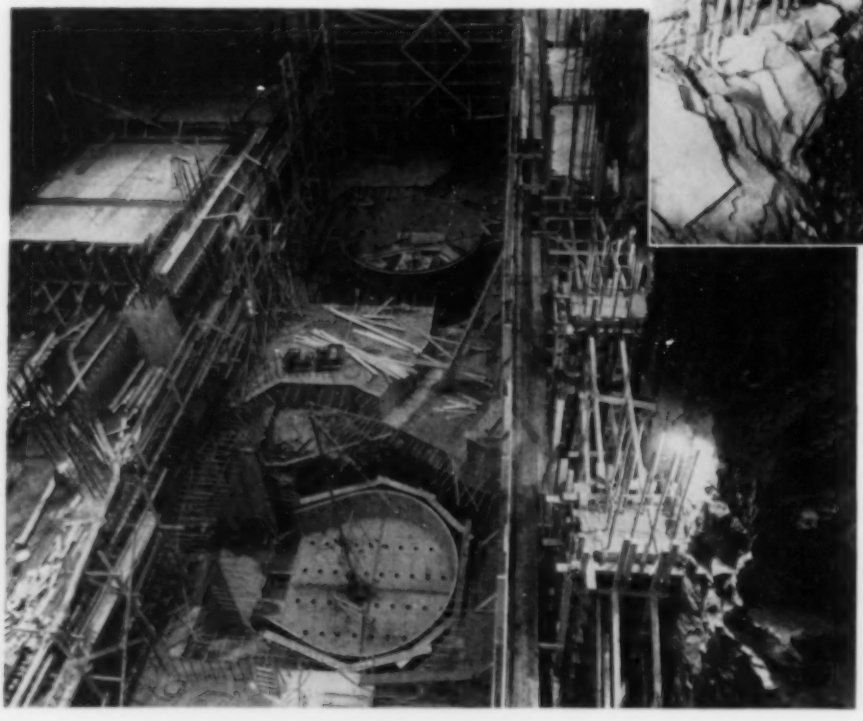
ENLARGING ACCESS TUNNEL

The access tunnel is one of four bores that were driven into the powerhouse for various purposes. Its main use is to provide a passageway at the generating-floor level for moving in powerhouse equipment. It is 27 feet wide and 31 feet high and was excavated by driving a top heading and then drilling out the lower section with wagon drills, as shown here.



POWERHOUSE IN THE MOUNTAIN

Hollowed out of solid rock a quarter of a mile inside a mountain, the Kemano powerhouse will be the biggest underground generating station. The upper part was excavated first, as shown above, and the arched concrete roof was put in place before the underlying rock was removed down to floor level. Forms for concreting were being erected when the view at the right was taken. In the foreground, a big truss is being hoisted through an opening to join others already in position. At present, preparations are being made to install the first three 140,000-hp generating units. The beginnings of two of these are pictured below. They are scheduled to go into operation by midyear.



drilling activity at the Kemano end of the tunnel. There the water will drop sixteen times the height of Niagara Falls to spin the power-producing turbogenerators—will plunge 2600 feet through two steel penstocks encased in solid rock bores. The latter were driven upward from the powerhouse level and from an intermediate point 1600 feet above where their 48° slope is broken by a horizontal section 685 feet long. The penstocks involved the excavating of 9200 feet of 15-foot-diameter tunnels.

Outstanding performance records were also made in driving the 6x10-foot pilot raises for these bores. Following survey lines established laboriously by engineers

MOBILE SLUSHER HOIST

Where each of the two penstocks branch off into four 9-foot-diameter conduits leading to the individual turbine locations, rock was excavated largely by scrapers powered by air hoists. These drew the material into the powerhouse area, where there was ample room for loading it into trucks. The picture shows a slusher hoist mounted on the rear end of a Koehring Dumptor truck so that it could be moved into any desired position.

traversing the rugged terrain of the mountain above, the headings broke through within an inch of their specified lines, causing one of the engineers to say, "This is good engineering and good mining in anybody's language."

Progress in excavating the pilot raises, including the time required for transporting men and materials and for timbering, drilling, blasting and mucking, ranged from 132 to 138 feet per 6-day week. The inclined raises were driven with CR-58 Stopehamers with 1¾-inch Carset bits. Air-powered Utility hoists were used to speed the handling of workers and materials.

The pilot raises were enlarged to the full diameter of 15 feet by pusher-type drills operated from a carriage or jumbo lowered from the top. All other drilling in the raises was done with DA-35 drifters or J-50 Jackhamers. Holes three inches in diameter for the skid track that was used to slide the steel penstock pipes or liners into position were put down with a DA-35 mounted on a mine car. Track supports are placed every 3 feet and necessitated the drilling of 10,316 holes from 9 to 12 inches deep. The penstock pipe sections are 45 feet long and weigh 40 tons. They come in 22½-foot lengths, which are automatically welded together on the job. They are then lowered and guided into position in the raises by welded angle skids which slide along the skid tracks.

Another major drilling job was the excavation of the underground power plant of unprecedented proportions. Located a quarter mile inside a mountain at the base of the penstocks, it is 710 feet long, 80 feet wide and 118 feet high, or spacious enough to accommodate eight generators. Three, each with a rating of 140,000 hp, are being put in under the present contract and are scheduled to go into service in April, May and June of this year. Eventually, there may be sixteen units, in which case the opening will have to be lengthened 400 feet. But before the additional generators could go into service, it would be necessary to impound more water on the east side of the range and advance another tunnel to carry it through the intervening rocky barrier.

As it now stands, the great cavern called for the removal of 248,700 cubic yards of rock. The work was started in October, 1951, and was finished last month. The upper part, next to the arched ceiling, was taken out first, the muck being allowed to fall down openings to a drift at floor level. After the roof was concreted (22,000 cubic yards was placed) the remainder of the material was slabbed off by drilling vertical holes.

Leading into the powerhouse from outside the mountain are four adits. One of them is 27 feet wide and 40 feet high and will serve as the tailrace for the water from the turbines. Another, the access tunnel provided primarily for taking in the equipment, is 27 feet wide and 31 feet high. The other two, a ventilation and a cable tunnel, are smaller in section.

Current from the generators will be stepped up to 230,000 volts by transformers inside the station and conducted to an outside terminal. There it will be put on the transmission system for delivery 50 miles away at Kitimat, the site of the aluminum smelter. Construction of the line was an outstanding accomplishment in itself, involving the erection of 306 steel towers and the stringing of 2¼-inch-diameter cable, the largest ever used overhead. It is designed to withstand the heavy ice loads it will receive where it crosses the mountains in a zone of eternal snow. Building the road along the right of way to take in supplies and equipment was an epic achievement. Before overland haulage was possible, they were brought in by means of helicopters.

The power that originates as moisture falling on the headwaters of the Fraser River will be put to work across the mountains at Kitimat. Men have been busy there, too, smoothing off the land for the smelter and the town that may someday have 30,000 to 50,000 inhabitants. A wharf 750 feet long is among the structures being provided. There the boats will unload the raw material for the aluminum pot lines. It will come from far-off Jamaica, which is rich in the earthy ore bauxite.

To save on transportation costs, the bauxite will be concentrated at the mines into a fine powder, aluminum oxide or alumina. This cuts down the volume by one-half. At Kitimat, 2 tons of alumina will be reduced to 1 ton of pure aluminum metal, which calls for a steady flow of electricity equivalent to 1 hp for three years. The initial output of 420,000 hp at Kemano will operate two pot lines and produce 90,000 short tons of aluminum ingots per annum. This can be increased by more than 160 percent by utilizing the full potential of the hydroelectric facilities now being provided. Any further increase—and the Aluminum Company of Canada had indicated that it may be expected—will send the hard-rock tunnelers and all the other construction workers back into the hinterland to start again where they leave off this time.

Directing the monumental undertaking for the Aluminum Company of Canada is P. E. Radley as project manager. F. T. Matthias is assistant manager, H. C. Jenkinson, chief resident engineer, K. Roestad, resident engineer at Kemano and C. W. Abrahamson, assistant. A. O. Strandberg is project manager for the contractor, R. E. Davis is tunnel superintendent and C. Swartz is powerhouse excavation superintendent. For British Columbia International Engineering, Limited, which is handling the engineering design, W. G. Huber is vice-president and general manager and J. K. Black is resident engineer at Kemano.

As the picture at the right makes clear, you don't have to have a scaffold to paint a high ceiling. With a new extension spray gun developed by the Eclipse Air Brush Company, Newark, N. J., one man can cover an area of 200 square feet from one position. The gun readily reaches second-story levels and can be used in or out of doors for a variety of domestic and industrial painting applications.

PHOTO FROM MILL & FACTORY

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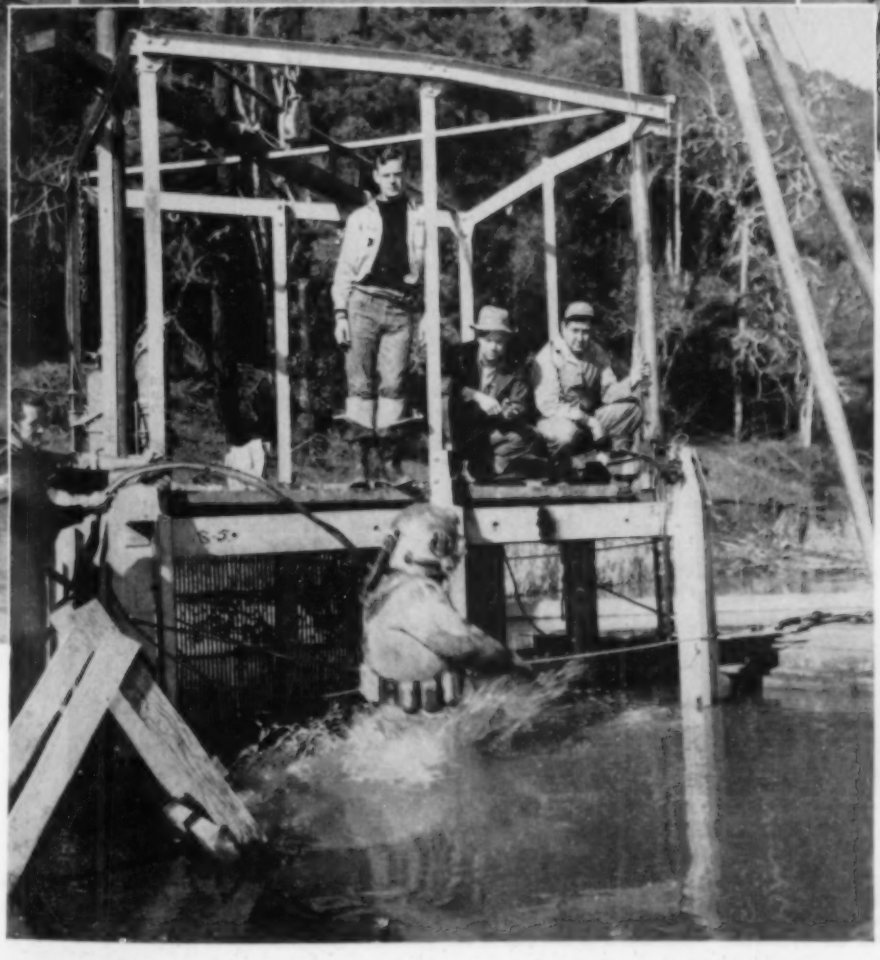
Paper cups manufactured in the Easton, Pa., factory of Dixie Cup Company are whisked from the machines that form them to packaging and shipping areas by air streams moving inside transparent plastic tubes, as illustrated below. Thus borne, they travel several hundred feet overhead, out of the way of other plant operations, and arrive clean and undamaged. The tubes are made by Busada Manufacturing Corporation of Maspeth, N. Y., from Tenite, a cellulose acetate butyrate plastic manufactured by Eastman Chemical Products, Inc., Kingsport, Tenn.

COMPRESSED AIR AT WORK

The investment process of casting metals is being increasingly utilized, especially in the jet-aircraft field. To provide efficient and convenient melting and casting equipment, Detroit Electric Furnace Division of Kuhlman Electric Company has developed the furnace pictured at the left. It is mounted on trunnions, and the investment mold is clamped on top of it by means of an air cylinder mounted underneath. Pouring is done by inverting the furnace. After the metal has set, the mold is detached and the furnace returned to the melting position and recharged for the next heat. With this equipment it is possible to produce an average of 40 intricate and accurately sized castings in an 8-hour day.



To the growing line of pneumatic tools that operate on the impact principle, the Ingersoll-Rand Company has added the Impacutter shown in action above. Its name aptly describes its field of application, and it will undoubtedly be used extensively in automobile-body repair shops. The tool weighs not more than 3 pounds 13 ounces and is only 7½ inches long. Power can be regulated to vary the action from light taps to full blows. The chisel, which can be any one of various types, is free to rotate and will cut in any position in relation to the handle. A sturdy wire retainer prevents it from becoming loose and flying off.

●

When debris from flood waters collapsed the intake of a tunnel carrying water out of Lake Van Arsdale in the mountainous section of Mendocino County, California, deep-sea diver Berger Rorvik was called in to make repairs. The picture at the left shows him leaping into the lake while his coworker Al Canet keeps his telephone line and air-supply hose from fouling.

WIDE WORLD PHOTO

Impactool Helps Load Oil-Well Gun

AN UNUSUAL application of the highly adaptable Ingersoll-Rand air-powered Impactool is that of helping to load what is known as an oil-well perforating gun. This strange weapon is employed far beneath the surface to penetrate steel casing in order that petroleum may enter it from the surrounding formation.

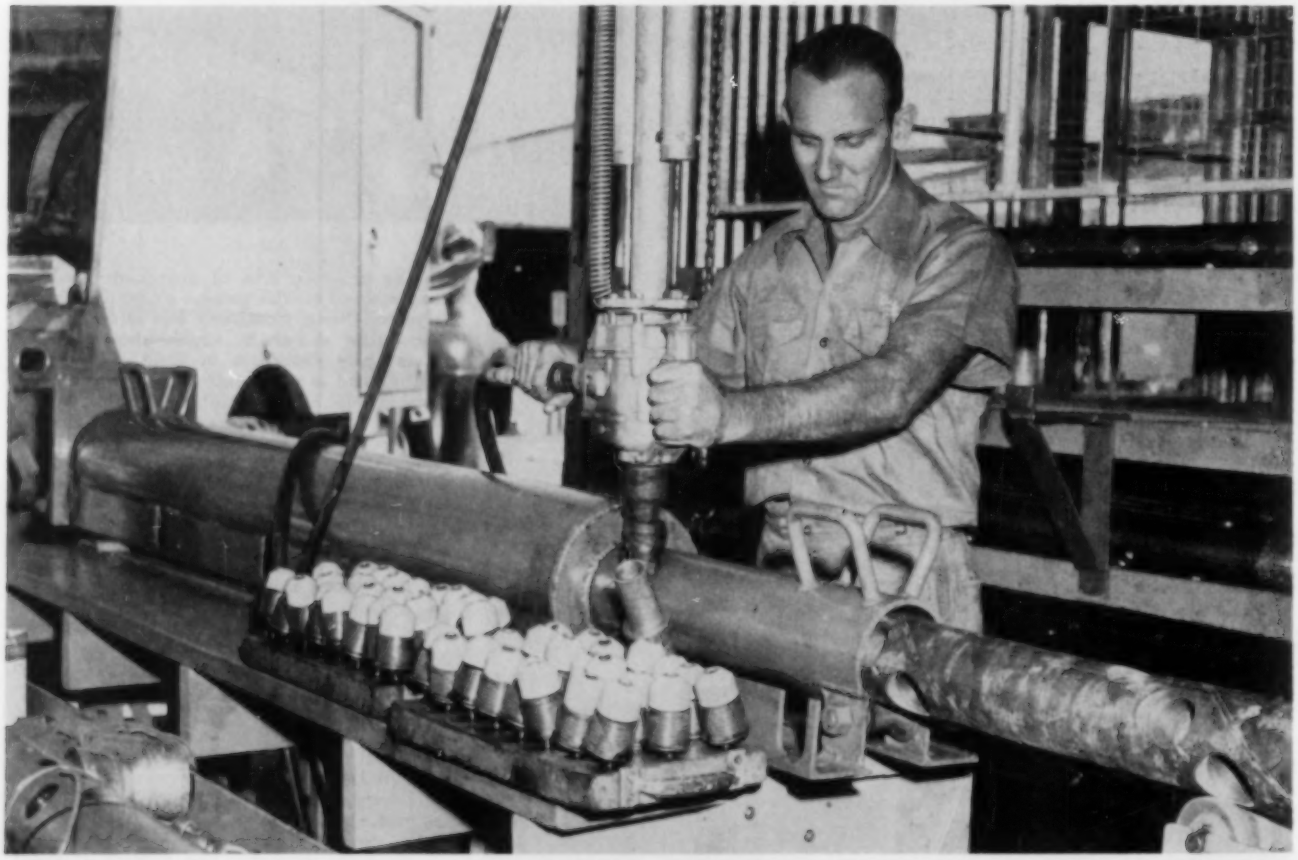
The gun block, the use of which has been developed into a highly specialized activity by Schlumberger Well Surveying Corporation of Houston, Tex., is made of a heavy steel bar having 24 spirally disposed drilled and tapped holes. Into the holes are threaded "cannons." These are heavy steel plugs each of which holds a ⅜-inch-diameter hard steel bullet and the powder to fire it. When loaded, the gun is lowered into a well to the correct depth. The charges are then detonated electrically from the surface, the steel bullets penetrating the casing and lodging in the enveloping rock. If the hopes of the drillers are fulfilled, oil flows into the well through the holes.

The Impactools, of which the Schlumberger organization now employs thirteen at widely scattered loading stations, are the Size 518 but are of special construction. They run in the cannons and tighten them with more than 300 foot-pounds of torque at the rate of a few seconds each. More important than their speedy performance, however, is a feature that eliminates all risk of injury to operators in case a plug should be accidentally discharged during loading. The precautionary measure is a 9/16-inch hole drilled entirely through the impact mechanism. A steel pipe 2 feet long is mounted on top of the tool in line with this hole to carry the bullet off harmlessly should something go wrong. Some of the tools in the more active stations install an average of 100 cannons a day. Although approximately 50,000 of the plugs have been threaded into place, no accident has yet occurred to test the safety feature.

The loading technique has become highly systematized. Methods that increase safety and efficiency are worked out in the shop at Shreveport, La., and then put into effect at the other stations. Loading has become a smooth, speedy operation from which the physical lifting of the heavy guns (up to 545 pounds each) has been eliminated and the danger of back strain and mashed fingers has, in consequence, virtually ended.

The guns are used over and over but must, naturally, be reloaded each time. When a truck of empty ones arrives at a loading station, a boom carrying block and tackle is swung out and transfers them to a rack inside the building. Later, they are rolled off the rack, one at a time, onto a line of rollers over which they are pushed to a wash room. There an air-powered Impactool backs each cannon out of its housing. No element of risk is involved, of course, and a standard Size 510 tool is utilized.

The gun is then thoroughly cleaned with steam and a detergent and rolled under a battery of infrared lamps that dries it in a few minutes. Careful cleaning goes a long way towards preventing mishaps when the weapon is next fired. After the electric circuits have been checked and igniters installed, it is taken to a workbench for loading. When that has been done, it is placed on a storage rack by block and tackle suspended from an overhead monorail. When the time comes to send it out with others, it is again transferred to the truck by block and tackle.

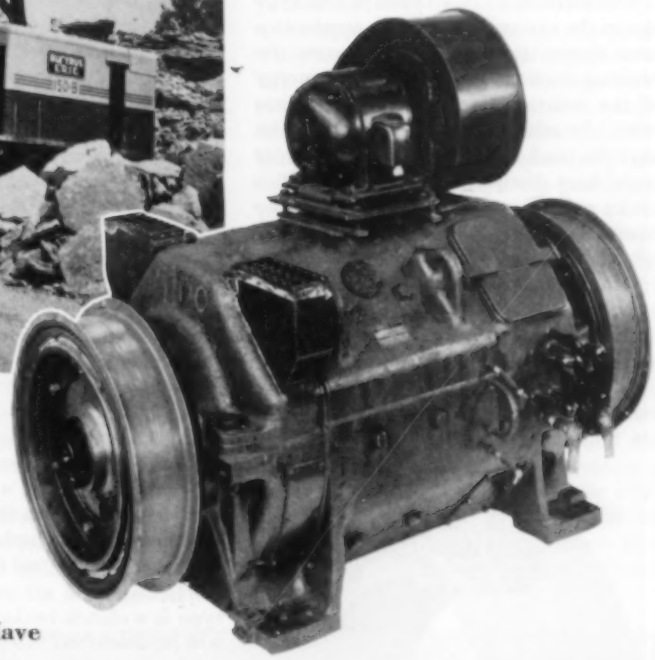


LOADING A GUN BLOCK

The operator is shown running a cannon into one of the threaded openings with a Size 518 Impactool. Other holes that will receive similar charges are visible at the right, and on the table are cannons awaiting insertion. The tool is held securely against the work by twin air cylinders actuated by a pedal. Extending upward from the center of the Impactool is a pipe through which a bullet would pass harmlessly in case it should be discharged accidentally. As each loaded cannon is screwed into position, that much of the gun is moved into a safety chamber (left).

POWER SHOVEL AND DRIVE

A Bucyrus-Erie 150-B power shovel with a capacity of 6 cubic yards is pictured loading an Easton truck in a limestone quarry. Below is shown the General Electric Company direct-current motor that drives the shovel's hoisting and propelling machinery through two Fawick Airflex clutches. Both clutches are electrically controlled. There is a similar clutch on the crowd mechanism for overload production.



Starting and Stopping Wheels of Industry

Air-operated Clutches and Brakes Have Numerous and Varied Applications

Robert J. Nemmers

TO MOST of us the mention of clutches and brakes brings to mind only those in automobiles. When one engages the clutch, it transmits power from the engine to the wheels. In many cases, actual clutch engagement is now done for us automatically. When one steps on the brake, woven asbestos linings are brought to bear on wheel drums to stop the car. In the latest models even the work of braking is done for us. And this, so far as many of us are concerned, is about the extent of our knowledge of clutches and brakes.

When we pause for a moment, however, to think of the vast number of machines necessary to our economy we realize that they, too, need clutches and brakes to start and stop them. Sometimes they are a great deal more powerful than automobiles, and clutches must often set rotating parts in motion and bring them to full speed in less than one revolution. Similarly, brakes must stop some of them within one revolution.

The development of clutches and brakes has followed closely the growth of machinery in size and power. At first, when equipment was small and operating speeds low, both were manually controlled. Then, as positive braking became a vital factor because of higher speeds, brakes were applied through a servo-manual system that supplied more power to the braking surfaces with a minimum of effort on the part of the operator. In time, clutches, too, followed this pattern and other advances in control mechanisms until, today, clutches and brakes are actuated by push buttons or by small pilot valves through servo-operated automatic devices. In this service, compressed air has found another application because its rapid reaction and flexibility make it an ideal, in fact well-nigh indispensable, medium for the purpose.

Air-operated clutches, brakes and combination clutch-brakes are being used in ever-increasing numbers on machine tools, earth-moving equipment, all classes of industrial drives, mine hoists, elevators, etc., and it is therefore impossible to cover each of the many types in detail. Only some of the best known will be described here in an effort to give a broad cross-sectional view of the field.

Brakes

In the following discussion of pneumatic brakes we have eliminated those intended for vehicles such as trucks, buses or trains* and have confined ourselves to those designed for stationary machinery or mobile equipment such as ore loaders. As an example of a basic type, let us examine one manufactured by the Industrial Brake Department of Goodyear Tire & Rubber Company. It consists essentially of a disc or wheel mounted on the driven shaft of the mechanism to be braked and of a brake housing or C-clamp arrangement placed so that the outer periphery of the wheel rides through the C-shaped section of the brake.

Incorporated in the C-clamp is an air cylinder. The free end of its piston is surfaced with a friction material which, when the cylinder is actuated, is brought in contact with the disc face, thus braking the machine. In order that the wheel may not be subjected to the strain of an

*See "Compressed Air Magazine," December, 1944, "Seventy-five Years of Air Brakes," and August, 1946, "Automotive Air Brakes."

unbalanced force, the surface of the clamp on the other side of it is also covered with a friction material, and either the disc or the clamp is made free-floating in line with the shaft so that the resulting forces are tangential to the wheel. But where it is not advisable to have either part free-floating, the brake housing may be equipped with opposing pneumatic cylinders. Variations of this basic design to adapt it for specific braking applications can be made by adding more brake housings or enlarging the cylinder to obtain increased torque.

One advantage of a brake of this type lies in the exposed disc which accelerates heat dissipation and thus increases the braking capacity because all the energy of the rotating parts is converted into heat. In addition, a special vaned disc may be used in cases where even more rapid heat dissipation is required. This brake may be operated hydraulically or manually or by a preloaded spring released by a servo-mechanism.

Other air-actuated units are typified by the Fawick Air-Ring and Airflex brakes. The former is suitable for small machines and is of the internally expanding type. It consists of a pair of metal housings on the inner one of which are mounted a hollow rubber-and-cord actuating tube, friction shoes, torque bars and release springs. Compressed air is admitted to the tube, causing it to expand and force the friction shoes against the outer housing or drum. When the air is exhausted, the springs, mounted horizontally in relation to the friction shoes, overcome centrifugal force and pull the shoes away from the drum. The torque bars serve as a means of transmitting the torque from the friction shoes to the inner housing. This Air-Ring brake may be obtained either with a revolving drum and a stationary brake unit, or vice versa.

The Airflex brake is of the constricting type. It also embodies the rubber-and-cord tube, which is permanently vulcanized to a steel rim. The friction shoes are mounted directly on the tube and the torque is carried through the latter's side walls. This unit is intended for heavy applications.

In addition to the brakes that are actually powered by compressed air, there are many others that accomplish braking by a preloaded spring and relieve braking tension by means of a pneumatic cylinder. These models take varied forms, the three most common being the "wrap-around," standard brake-shoe and disc types. The first one consists of a flexible strap that is partially wrapped around a drum and has a friction material on the contacting side. One end of it is anchored securely and the other is attached to a spring-loading mechanism and air cylinder. The disc type is a clutch-brake combination that will be described later.

There is still another kind—the gravity operated brake. In this case braking is done by means of a large weight, the force of gravity being transmitted to the brake proper through mechanical linkages. This unit uses compressed air to lift the weight to release brake pressure and is said to be about the ultimate in operating safety because there is no chance of power failure.

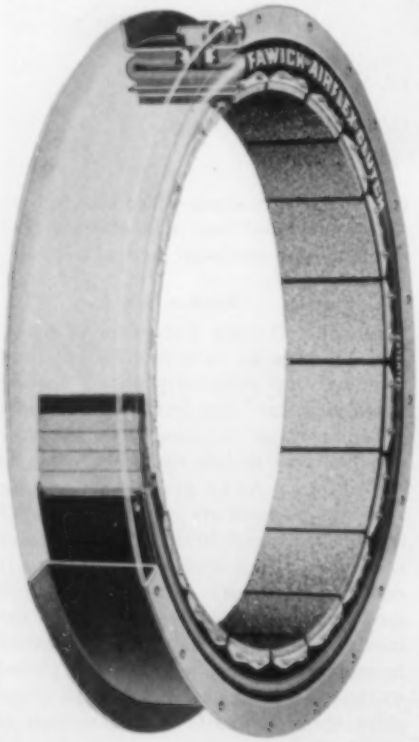
Clutches

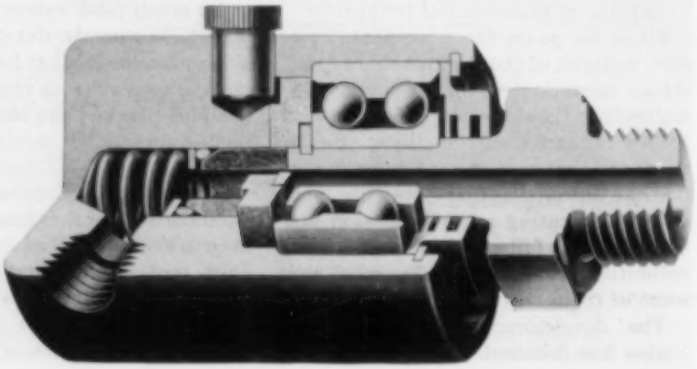
In the field of clutches one may arbitrarily break down the units into two groups: those that provide positive engagement through intermeshing gears or teeth and those that provide sliding engagement through a friction device of one sort or another. Among the former are two types that use compressed air as the actuating medium. One is a sliding gear clutch made up of a gear that has a sliding fit on a hexagonal drive shaft and meshes with an internal gear mounted on the driven machine. Engagement is brought about by a pneumatic cylinder mounted on the drive shaft and acting against the sliding member.

Although this clutch is slip-proof, it has several disadvantages all connected with the meshing of the teeth. First, no error is allowable in engaging the two gears. If the sliding gear is brought in contact at the right moment, the gears will mesh evenly; but if the sliding gear is a little out of alignment with the internal ring gear, it takes considerable sliding and grinding of the gears to effect final engagement. Second, an appreciable amount of end thrust is required to engage the two gears, especially under heavy loads, and the machine as well as the clutch must be constructed to withstand that thrust.

The other positive type is the internally expanding jaw clutch. It is composed of two bars that slide radially in relation to the drive shaft and of jaws that are at the outer extremities of the bars and designed so as to mesh with an internal gear. Engagement is effected by the action of a pneumatic cylinder through mechanical linkages. This type is more easily engaged than the sliding gear clutch mainly because there is only one thing to be avoided in aligning it and that is engaging the teeth exactly on the points. At any other place the teeth mesh with but a minimum of slippage and without grinding. Furthermore, there is no end thrust on the driver or driven element. Wear is compensated for by radial adjustment of the jaws. General application of this type of clutch is in the extremely heavy-duty field where speeds are relatively low and where absolute, positive engagement is essential.

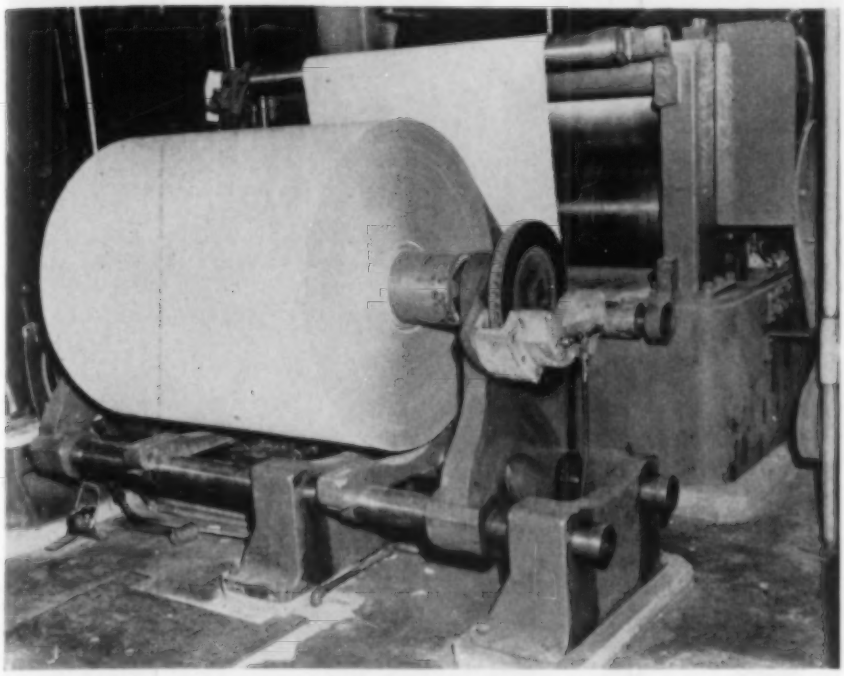
Where service calls for high rotative speeds it is usually not advisable to utilize positive-action clutches because both the driver and driven element would have to be of such heavy construction to withstand the resultant jar





FAWICK AIRFLEX CLUTCH COMPONENTS

The sectional view above shows the composition rubber-and-cord actuating tube, friction shoes and, at the top, the means of admitting air to the tube. The other picture shows the Fawick Rotorseal which is used to transmit air from stationary piping to rapidly revolving members such as a clutch. Air admitted at the right end is taken off radially at the left. A preloaded spring forces nonmetallic packing against the stationary member to insure a tight seal. A double ball bearing prevents deflection of the revolving member.



PAPER-ROLL UNWIND BRAKE

A Dilts unwind machine serving a paper-coating machine in a Bemis Brothers Bag Company mill. The unwinder, equipped with a Goodyear industrial disc brake, maintains a constant drag on the paper to feed it smoothly. The brake is of the vaned type which dissipates heat rapidly. Power is applied through two air cylinders. A guard customarily covers the brake, but it was removed in order to take the picture.

and shock as to materially increase their weight and cost and horsepower requirements. To meet those needs, engineers have devised different types of friction clutches that permit a small amount of slippage before the pressure on the friction plates reaches a point where the units become essentially one so far as movement is concerned.

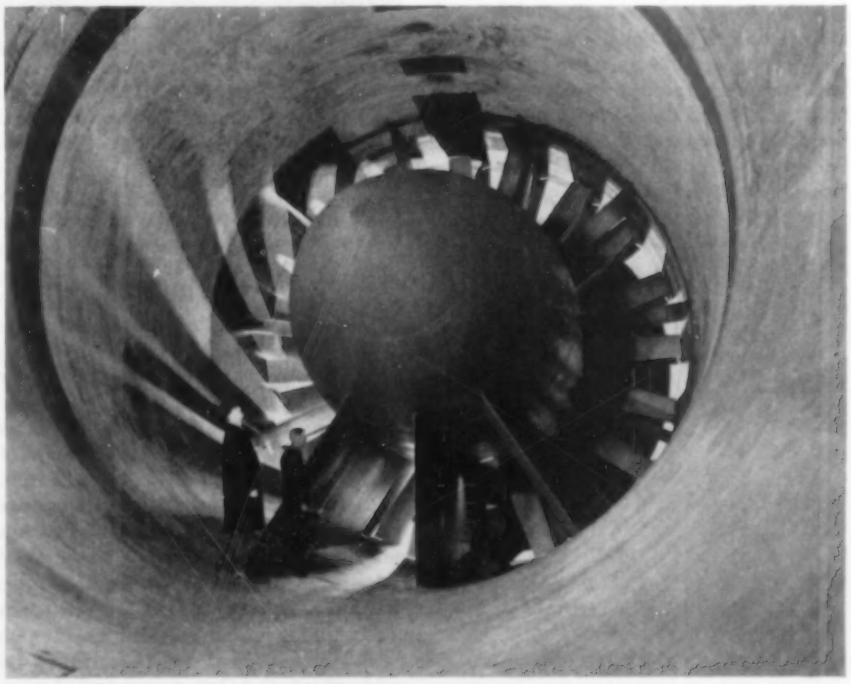
Perhaps the most familiar model of this design is the cone clutch which has served automobiles well for many years. But for industrial purposes, engagement is often effected through the medium of pneumatic cylinders rather than the spring-loading device found in cars. It features a circular wedge in which one cone with a friction material on its outer surface is forced into another cone having a different friction material on the inner wall. Another type that is sometimes used has an expanding cone inside a rigid cone with which it comes in contact.

The cone clutch is capable of automatic wear adjustment and of transmitting considerable torque, while the expanding type offers a large friction surface in a comparatively small width. The latter advantage, however, is partially offset by the difficulty of keeping the friction faces in perfect alignment so that the entire surface is in use. This drawback shows up particularly in high-speed clutching operations where starts and stops follow one another in rapid succession.

For forging machines, presses, press-brakes and other similar equipment that need high-speed, frequently acting clutches the Industrial Clutch Corporation has designed a combination clutch-brake that has been applied successfully. It is of the friction type in which a series of discs mounted on the driver are clamped by means of a pneumatic cylinder between another series on the driven element. The unit is arranged so that, when the air supply is shut off, a set of powerful springs separates the clutch discs and then brings the discs on the driven element to bear on a group of similar but anchored brake discs.

Clutch-brakes come in sizes capable of transmitting more than 1000 hp and permit virtually instantaneous starting and stopping, according to the company. They are rated to stop the machines on which they are mounted within one revolution at 600 rpm, and the firm's engineers are working for the same speed of action at 1000 rpm for special purposes. In the case of this design, the pneumatic pressure acts directly upon the clutch and may be regulated so that the latter will slip at a certain overload, where slippage is permissible, thus protecting the machine and cushioning the flywheel effect.

A clutch that has been found to reduce maintenance to a minimum and to require no adjustment is the expander-tube model of which the Airflex and Air-Ring clutches, products of a division of Federal Fawick Corporation, the original patent holder of the type, are examples. They work on the same principle as the expanding-tube Fawick



WIND-TUNNEL FAN

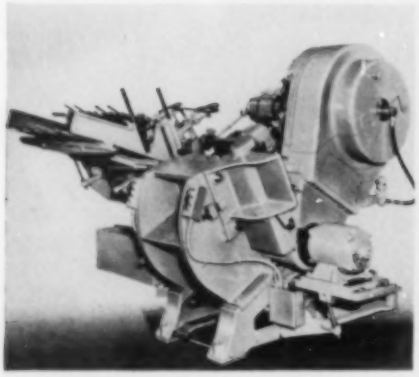
This gigantic fan, 26 feet in diameter, creates air currents with a velocity of close to 700 miles per hour that enable United Aircraft Corporation to conduct airplane tests. When rotating at 500 rpm, it develops 82 million foot-pounds of kinetic energy. The brake consists of three dual-opposed air-operated Goodyear units acting on a single 6-foot rotating disc and can stop the huge unit in 150 seconds. The air drag of the fan also assists in slowing it down.

brakes described previously. An advantage of the Airflex clutch is its flexibility, which allows it to adjust itself for axial deflection and drum distortion and still operate efficiently. No adjustment is needed because the tube compensates for wear on the friction surface. Furthermore, it can be used with moving or stationary drums, as desired. The selection of an expanding or a constricting model depends, of course, upon the duty to be performed, but generally the former is for slow speeds and the constricting type for higher speeds.

The Fawick clutch and brake may be combined so that disengagement of the clutch by means of a suitable control valve will result in brake engagement and vice versa. This arrangement makes it possible to apply the Airflex principle of braking and clutching to presses, shears and other cyclically operated machinery. The constricting type, constructed so that the engaging surfaces are at the outside of the drum at maximum diameter, provides the greatest torque per area unit of contact and, because of the design of the rubber-and-cork tube and its friction shoes, assures 360° contact around the drum.

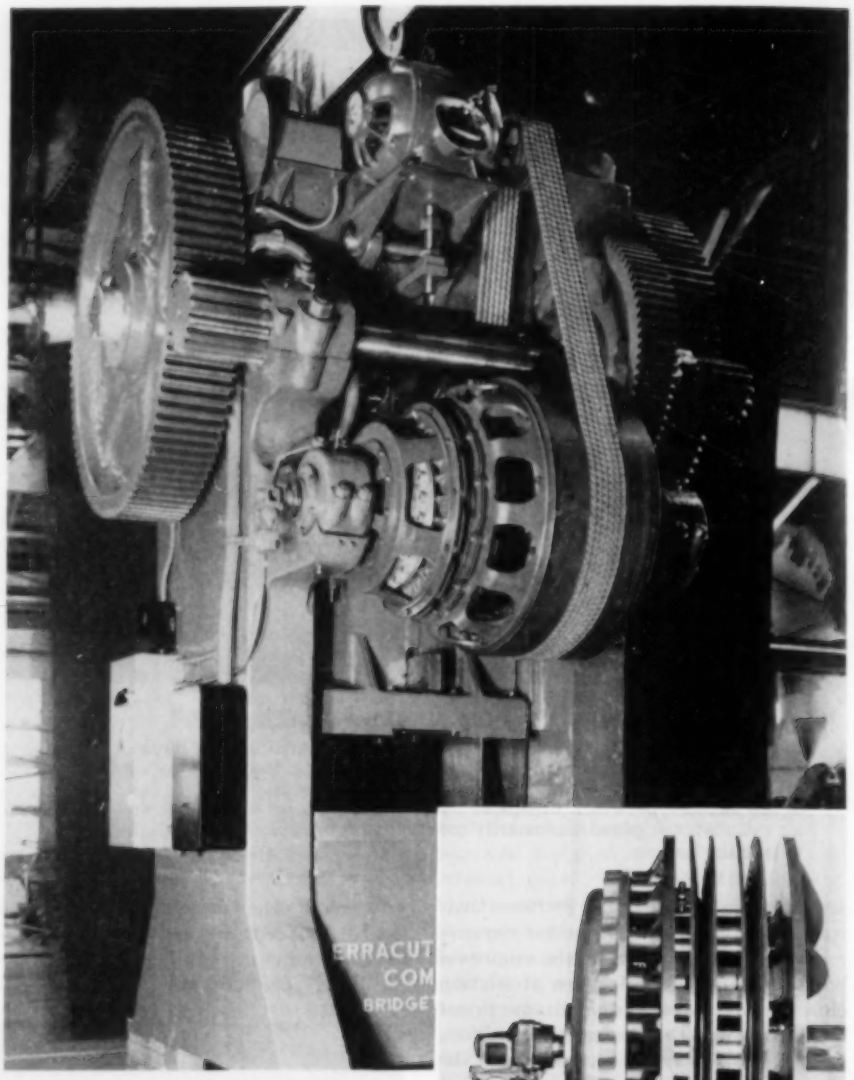
Selection and Control

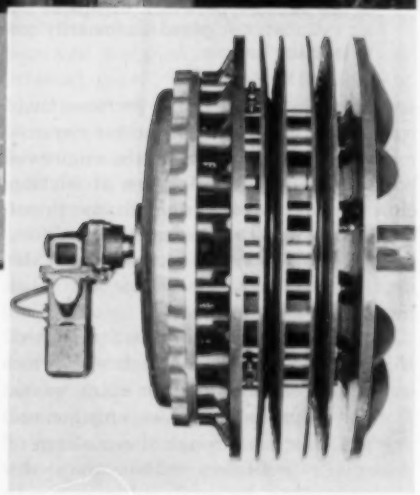
The selection of a properly rated brake or clutch for modern machinery depends on knowing the WR^2 of the rotating masses. This value is essentially a mass-energy ratio of the inertia forces present in a machine at rest and in motion. The Industrial Clutch Corporation has developed a torsional pendulum of simple design by which the WR^2 value of concentric parts may be determined, and has offered plans of the device to industry at large. Use of the mechanism depends on knowing the WR^2 value of a rotating disc pendulum and then arranging parts of unknown values concentrically around the disc. The latter is then made to oscillate, and the period of oscillation is timed with a stop watch. With the time interval known, together with the equations furnished by the company, it is possible to calculate the WR^2 value by a process of subtraction.



CLUTCH-DRIVEN PRESS

A Hamilton 25-ton strip-feed press for the high-speed production of light stampings such as can ends and screw caps. Driven by a Westinghouse motor, the press is equipped with a Fawick Airflex clutch-and-brake combination. The strip feeding mechanism is also air operated.





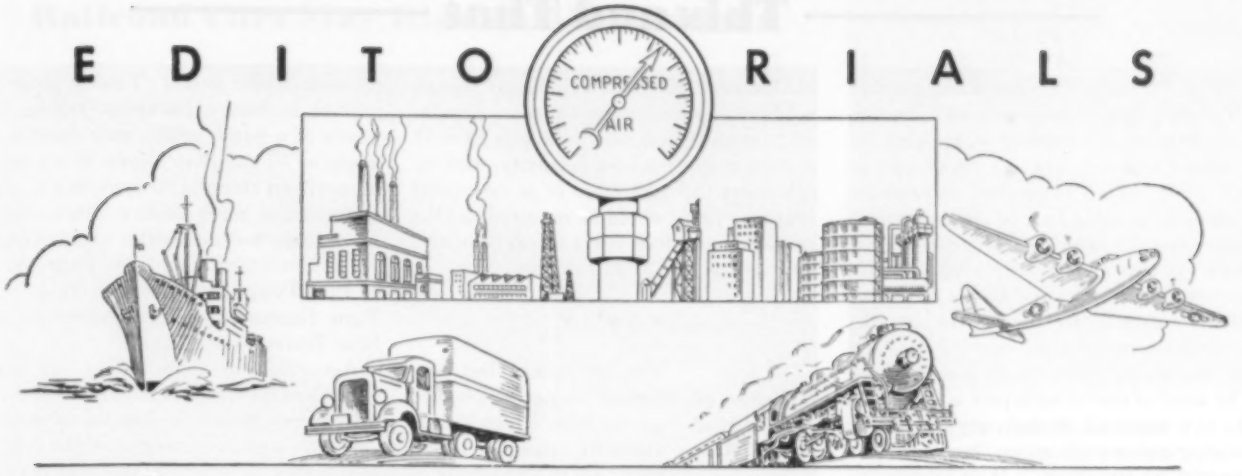
PRESS CLUTCH-BRAKE

An Industrial Clutch Company clutch-brake assembly mounted on a Ferracute 350-ton straight-side press. Vee-lox belts drive the machine through the clutch, which is controlled by a Ross solenoid valve. The right-hand picture shows the driver assembly, clutch hub and plates. The center plates are axially shiftable to the right to engage two constantly revolving clutch friction shoes (not shown) and to the left to engage an anchored brake shoe (also not shown).

Many different types of control valves are available for clutches and brakes—so many, in fact, that only the Ross solenoid-actuated, pilot-operated 3-way valve will be dealt with because it happens to be a typical one. Of the normally closed type, it is often used with Industrial Clutch Corporation clutch-brakes. When the solenoid is energized, the solenoid armature acts to operate the pilot valve which, in turn, admits air to pistons controlling the main valve. Because air pressure is used to do the hard work of opening the valves, reaction is almost instantaneous. Similarly, de-energizing the solenoid exhausts the air in the clutch cylinder, again almost instantaneously, and causes the brakes to take effect.

When it was first discovered that compressed air in combination with the proper tools was powerful enough to engage the clutches on or stop the biggest of our modern machines the only thing that limited the reactive speed of a clutch or brake was the method of control. It was not until the air pilot valve was adapted for this field of service that the exceedingly fast operating speeds of today's clutches and brakes became possible.

EDITORIALS



SAN FRANCISCANS PROTEST

EIGHTY years ago last month Andrew S. Hallidie of San Francisco announced his wondrous scheme of pulling street cars by attaching them to a cable moving in a slot beneath the surface. The coast city welcomed the idea as an improvement on the horse cars necessary to negotiate the abounding hills and bogs, and before the expiration of 1873, cable cars were running on San Francisco streets.

Although numerous other municipalities adopted the new mode of transit, it reached its fullest development where it originated, and in time San Francisco had 200 miles of cable-car lines. Because the topography favored them, they were retained there long after most other communities had discarded them. Some years ago they began to attract the attention of tourists. Visitors called them quaint, patronized them and talked about them when they returned home.

Gradually, San Franciscans realized that they had something distinctive, something that formed a tie with the city's pioneer days, and they decided that the link should not be allowed to disappear. But when the eightieth anniversary of the cars was being observed, just two lines remained and a move was on foot to cut the 11-mile system in half. Despite vociferous objections from wrought-up residents, it seemed probable that a further compromise would have to be made with modernity by leaving only the section extending from Fisherman's Wharf to the turntable at Powell and Market streets.

The same group of recalcitrants was also resisting what seemed to be a campaign to do away with the city's last ferryboats. Before the bridge across the bay was opened in 1937 all persons entering or leaving San Francisco, including commuters, used ferries from and to Oakland. As many as 43 boats were once in service, and in a single year 40 million passengers and six million vehicles were floated across. Now there are just two, and they operate only to serve travelers on two midday Southern Pacific Railroad trains running between Oakland and Sacramento.

The railway was recently ordered by the State Public Utilities Commission to study and report on the feasibility of carrying these passengers by bus over the bay bridge with the idea of saving time. Irate citizens immediately protested any such action, and they are getting a lot of support from the newspapers. The latter have expressed the fear that San Francisco will eventually lose its "color" and become "just as unromantic as the big bulk of other American cities."

RESEARCH ON ABSENTEEISM

THE whys and wherefores of absenteeism are being sought in an effort to help employers cope with this pressing problem. The study, directed by the Research Council for Economic Security, a Chicago organization, has been in progress for two years. It has concerned itself so far only with absences of more than four weeks occasioned by unoccupational disabilities. Less than 25,000 persons have been covered—only one-sixteenth of the 400,000 to be investigated in order to obtain a 1 percent sampling of the nation's nonagricultural workers. Findings therefore cannot be considered typical, but some of them are interesting.

Among 22,778 employees of fifteen large industries throughout the country, absences of the type mentioned were at the rate of 33 per 1000 persons. Of 1212 absences analyzed in 32 plants, 70 percent were men and 30 percent women. Among the men, 87.3 percent were production workers and only 12.7 percent in sales, supervisory, clerical or other salaried groups. Among the women, 71.2 percent were nonsalaried and 28.8 percent salaried.

Workers earning less than $3500 annually accounted for 62 percent of the absences, those in the $3500-4999 bracket for 27 percent and those above $5000 for only 11 percent. The median age of all those involved was 43.6 years. The average length of employment was 8 8 years. The figures thus pertain to workers of such experience that their absences would detract considerably from the efficient operation of their establishments.

Statistics indicate that 95 percent of prolonged worker absences result from off-the-job hazards. But despite this, major attention has been given to occupational causes. This study is an effort to equalize the situation.

BRIDGE SHORTCOMINGS

ALTHOUGH superhighways and toll roads are easing the traffic worries of harried drivers in some areas, there are still ponderous problems to be solved. The American Automobile Association calls bridges the weakest links in our highway system, declaring that 170,000 of the 500,000 structures in the national network are inadequate for current needs. Moreover, 84,000 of the deficient ones are on roads that carry 80 percent of our automotive traffic. Out of 12,000 bridges on main arteries, 1600 were designed to carry maximum loads of 20 tons, whereas loads up to 30 tons are now common. So far as is known, only one state, Ohio, has carefully checked its highway bridge situation. It found that 40 percent of the structures in rural sections were either not as wide or not as strong as they ought to be.

It is conservatively estimated that it would cost around three billion dollars to put the country's bridges in good order either by improving existing ones where that is feasible or replacing them where such action is required. Incidentally, bridges are the most expensive parts of our travelways, but modern ones are built to last at least 50 years before needing extensive repairs.

Narrow bridges are the greatest single cause of bottlenecks that impede traffic. They also are the foremost cause of accidents of the sideswiping variety.

This and That

Tickling Rats' Palates with Plastics

Because some plastics have proved to be unusually appetizing to rats, the Minneapolis-Honeywell Regulator Company is using four of the rodents to determine if a new kind is proof against their ravages. Two of the creatures are each receiving one good feed a day, plus an after-dinner serving of the plastic, while the other two get short rations and all the plastic they could possibly eat. The meal of one of each pair is served on the new material. So far, only the rodent on short rations placed on the plastic has gnawed on his "dish." The laboratory technicians are continuing the experiments to see how much damage the rat will do. If he shows a real taste for the material they will add a repellent to it.

* * *

Locomotives Put Out to Pasture

As a result of a public-relations program undertaken by the St. Louis - San Francisco Railroad, children in several communities are clambering with glee over real full-size steam locomotives while their elders divert themselves by inspecting their mechanical features. The fifth iron horse to be retired by the line was recently set up in Grant Beach Park, Springfield, Mo., a sixth has been accepted by the citizens of Tulsa, Okla., and the four others have been given to Birmingham, Ala., Memphis, Tenn., Amory, Miss., and Kansas City, Mo.

Purchased new about ten years ago at a cost of $198,000, the Springfield engine weighs 820,000 pounds and required a crew of 23 men and a week's time to transport it across the city. The feat was accomplished by operating it with compressed air and rolling it on short sections of track. Derricks picked up the rails after the locomotive had passed over them and then replaced them in its path. Individually, the engines have an unrealized scrap value of $15,000, and the cost of getting them to a public park comes to from $7000 to $10,000. This expense, together with maintenance, is absorbed by the railroad.

* * *

May Link Sweden and Denmark

A combination of six Swedish and Danish contractors has proposed building a bridge-tunnel highway across the sound between the two countries if the respective governments approve. From Malmö, Sweden, eastward to Salthomen Island there would be a 4-mile bridge with the main span 1000 feet long and 150 feet high. From the island to Denmark, the road would run through a 1¾-mile subaqueous tunnel. The facility is being designed to handle 10 to 15 million motor vehicles annually, with no provision for bicycles. It is estimated that two years would be required to plan the work and five years to carry it out. The cost is put at $70 million.

* * *

Bricks of Nile Mud Defy Rain

The infrequent but torrential rains which fall on the Nile River Valley annually cause the disintegration of thousands of Egyptian village homes. These are built of sun-dried bricks made of Nile mud, which has been used for this purpose for centuries. American researchers have recently solved the problem, which was further complicated by two facts: first, the country does not manufacture enough construction materials of the kind that would serve the villagers' needs, and, second, high transportation costs and the lack of adequate roads nullified the possibility of utilizing prefabricated materials. Thus limited, technologists of Arthur D. Little, Inc., came to the rescue by developing a stabilized sun-dried brick that is water-resistant and can be produced of Nile mud by the method commonly practiced in Egypt.

* * *

Harmony from Old Oil Drums

Discarded oil drums are playing a new kind of music down in the Caribbean Islands where calypso singers have already made exciting musical history. Whole orchestras, known as "steel bands," are composed of "pans" made of the metal containers. The latter are carefully converted into the tonal counterparts of instruments in a traditional orchestra, a transition that requires a musician's ear and a blacksmith's craftsmanship.

The drums are cut with a hacksaw, heated and then beaten with a sledge-hammer until the head is concave. Gentle hammer taps then serve to fix the pitch of each of the 32 notes that may be achieved on a pan and that are marked off with white paint. Tuning must be precise to insure harmony among the pieces of a band, which may number as many as 30 and play almost any kind of music from rhumba to symphony. The instruments, some shallow, others waist-high, are beaten with rubber-tipped sticks in a whirling motion. Pans known as Ping Pongs form the melody section, Tune Booms furnish the harmony and Bass Booms the rhythm.

According to ethnologists, the steel bands are direct descendants of the voodoo drums from the jungles of Africa. They are a vital expression of the culture of a people to whom music and rhythm are innate.

* * *

Vacuum Melting Process

A new process for melting steel, designated as closed-circuit melting, will be put in operation by Universal-Cyclops Steel Corporation upon the completion of new facilities now under construction at Bridgeville, Pa. By melting under a vacuum, or in the presence of an inert or reducing gas, the composition and pressure of the atmosphere may be controlled as desired and will permit successfully melting alloy steels containing large quantities of highly reactive elements such as titanium, zirconium, aluminum and magnesium, all of which prove troublesome in commercial electric furnaces.

The closed-circuit system will, it is claimed, provide a complete "cover" for the melting process, thereby protecting the chemical reactions in the molten bath from all the variables in outside air such as moisture, gases and pressure. Basic features of the process have been used experimentally in laboratories in this country and abroad for several years, but the new plant will be the first one of commercial size.

* * *

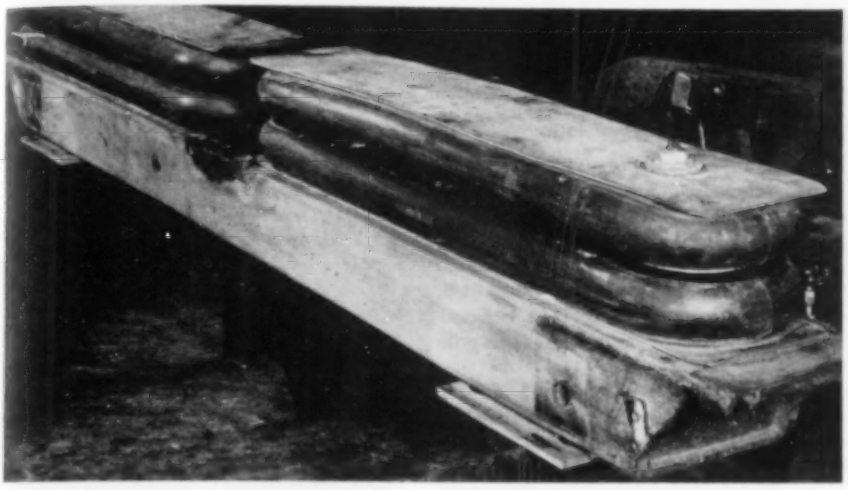
Deepest American Mine

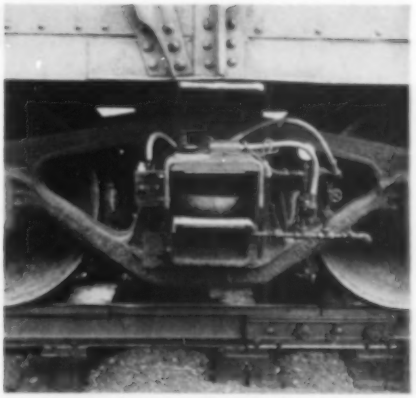
Lake Shore Mines, long the deepest source of ore in North America, has carried its workings still farther down. New development levels have been established at depths of 7950 and 8075 feet below the surface, and the 3-compartment shaft extends an additional 100 feet into the bowels of the earth. Although the mine has been plagued for years by "rock bursts" and has therefore had to exercise great care in mining, rock conditions observed so far in the new deep openings are described as excellent. The Lake Shore, largest gold producer in the Kirkland Lake District, has paid dividends exceeding $100 million since 1918.

Baseball Note

Wilmer J. O'Brien, who operates a practice baseball batting cage with automatic pitchers at Revere Beach, Mass., says a magnesium bat outlasts a dozen wooden ones. He had one made up by Fred Hengesch of Castalloy, Inc., Natick, Mass., and will perhaps patent the idea. During the 1953 summer O'Brien's patrons broke 300 wooden bats. The magnesium one was good for two months.

Railroad Cars May Ride on Air Cushions





TEST INSTALLATION

Two air-cell springs, their length equal to the width of a railroad car, are pictured at the left with the truck bolster removed. The other view shows the end of one of the cushions as installed under a car.

THE standard steel coil springs with which most railroad freight and passenger cars are equipped will, when traveling over rough stretches of track, cause them to oscillate vertically or to recoil, the amplitude increasing as the pay load decreases. To counteract this effect, shock absorbers, snubbers or elliptical springs are used with a measure of improvement. But to add further to passenger comfort, engineers of the General Tire & Rubber Company and The Timken Roller Bearing Company have developed an air spring or cushion that is designed to replace the conventional steel-spring suspension in rail trucks.

In appearance, the new spring is much like a rubber life raft with the gunwales pressed together and with one side riding atop the other. For the purpose of preliminary tests, a unit was mounted in the somewhat modified Timken bearing-equipped truck of a freight car, and sensitive measuring and recording devices were attached to the car as well as to a similar one with standard coil springs. It is reported that the instruments showed conclusively that vertical oscillation was considerably reduced both in amplitude and frequency, indicating a smoother ride as well as less freight damage due to up-and-down jolting.

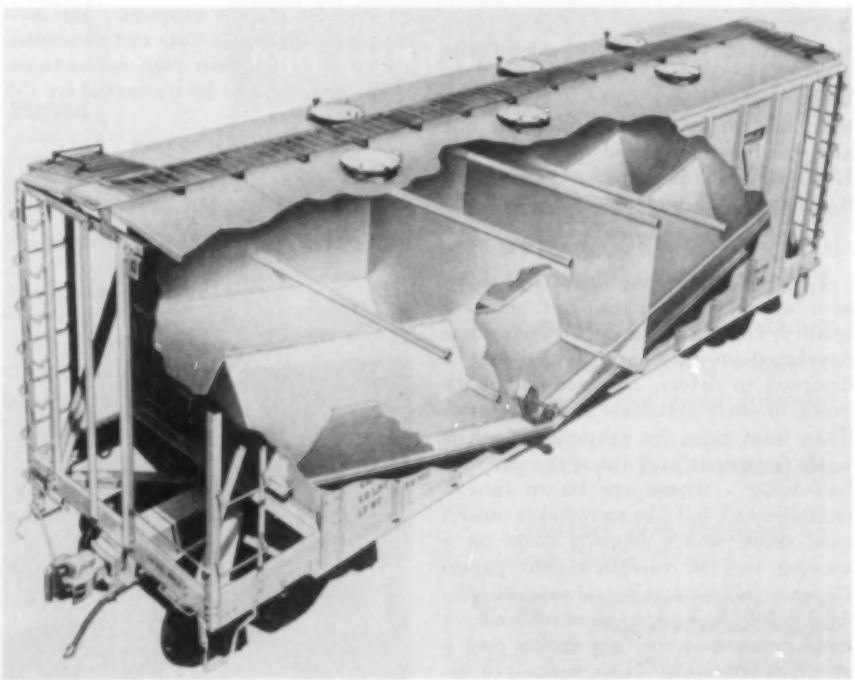
Air to inflate the rubber bellows of the pneumatic cushion is obtained from the train air-brake line and is fed through an automatic regulator that varies the pressure with the load to keep the car body at a constant height. Should the air fail for any reason, rubber shock pads in the spring take over and enable the train to continue to a terminal for repairs. In the case of a fully laden freight car, pressure on the pneumatic springs will probably range from 35 to 70 psi. Deflection per pound of load when running under full capacity is about twice that of leaf-spring suspension and around four or five times as much when traveling light.

Air Helps Unload Bulk Material from Rail Car

A COVERED hopper car known as the Airslide Car, designed for the bulk shipment of dry, powdered or granular material, is offered for lease by General American Transportation Corporation. Loading is by gravity through water-tight roof hatches and unloading is facilitated by two trenches running the full length of the car on each side of the center sill.

Attached to the bottom of each trench is an Airslide made of silicone-treated fabric ¼ inch thick and 12 inches wide. The underside of each slide is completely encased in a U-shaped light-gauge steel section or chamber into which low-pressure air is admitted. This filters through the fabric, aerating the bulk material to prevent packing or bridging and causing it to flow down the chutes by gravity. The latter slope at an angle of approximately 15° to the discharge outlets which are near the center of the car.

Air not exceeding 2 psi is used and is supplied by a blower with a capacity of 200 cfm. It is delivered through a hose connected to the bottom of each slide. The discharge ports are located 14 inches above the top of the rails so that the lading can be fed into hoppers below the track or carried to storage by any mechanical or pneumatic conveying system. The cars are built in three sizes with a maximum carrying capacity of 156,500 pounds.



Industrial Notes

To simplify the work of setting up concrete forms in road construction, Ingersoll-Rand has announced the addition of an air-operated pin driver to its line of paving breakers. Known as the PB-59,

it weighs 50 pounds and is equipped with a fronthead that enables the operator, it is claimed, to drive pins straighter and tighter than by hand hammering and in from five to ten seconds each. When not required for that purpose, the tool can be converted by means of other accessories to demolition, digging, backfill-tamping and other jobs. It lends itself especially well for use on scaffolding where its lightweight and ease of handling are desirable features.

Circle 1E on reply card

Steel shot and grit for blasting, peening, tumbling, cutting and abrading purposes are now being made by a new cold-forming method. The Steel Shot Corporation, organized to exploit the process, claims that its product not only has greater strength and will last longer than that made by older methods but also that it can be turned out at less cost. It is now available in particle sizes from 0.032 to 0.3125 inch.

Circle 2E on reply card

To speed the production of and to insure electrical insulation of uniform quality, General Electric Company has developed an automatic device that is designed to detect, measure and mark voids in such materials in sheet form. Take mica tape, for example, which is made from splittings about the size of a half-dollar. These are blown into a chamber and fall like snowflakes onto a steel drum which deposits them on a moving web of varnish-soaked paper. Because the mica is not always distributed evenly, open places are left and are hand-patched as the tape moves past a group of operators. Now, instead of being examined by trained inspectors to determine the number and size of remaining voids, the material travels through the new device, which gives a permanent record of quality by means of a photoelectric recorder. When a bare spot passes between the detection elements, current flows and is measured, and if the area exceeds the permissible limit, a signal sounds and a drop of dye marks the place so it can be covered. The company claims that a year's test of the automatic inspector has boosted the production of mica tape 260 percent.

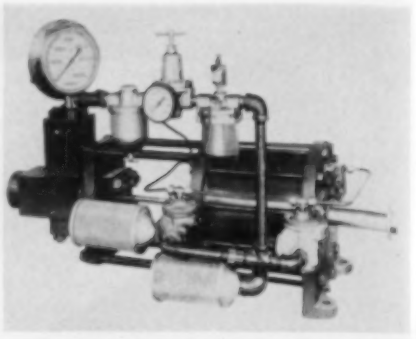
Circle 3E on reply card

Marking pipe joints for cutting is easy, it is claimed, with a layout tool designed by Contour Marker Corporation. It is offered in two sizes for diameters ranging from 1½ to 18 inches and from 16 to 48 inches. According to the manufacturer, the average pipe joint can be marked in about five minutes by setting a dial, divided in degrees and pitch, to the desired angle and then tracing the cutting line on the pipe with a soapstone point on an articulated arm.

Circle 4E on reply card

The increasing complexity of mechanical press operations has created a demand for a compact air-control system so that an operator, without moving from his working station, can actuate clutch and service brakes, counterbalance cylinders, die cushions, lifters, gauge stops and unloading devices, and perform other necessary functions. This need has been met, it is reported, by The Republic Manufacturing Company, which has combined in one bronze casting all the valves and regulators normally required for the purpose. The new manifold is 9 inches wide and eliminates as many as fourteen pipe connections. Eight of them can be connected by the use of headers.

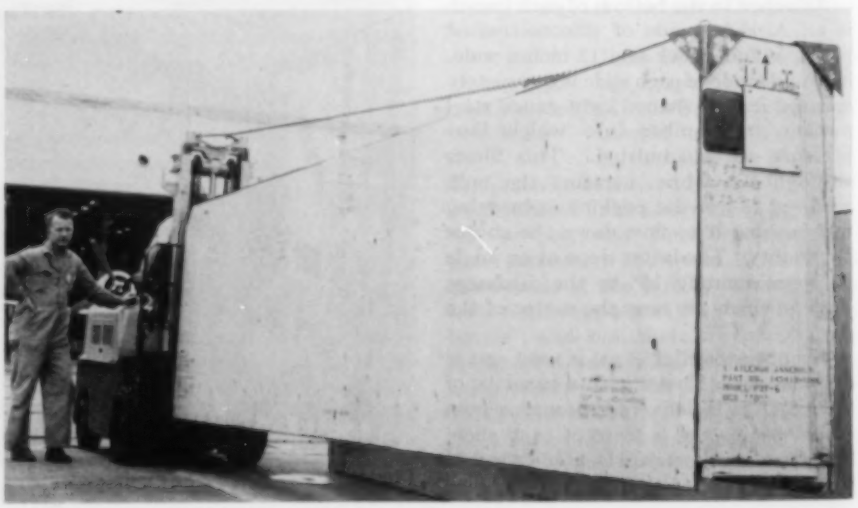
Circle 5E on reply card



Production of a new air-driven hydraulic pump of the simplex horizontal type that meets the demand for a unit of small-volume capacity at medium or high pressures has been announced by The Aldrich Pump Company. It is available in single- and double-acting models. Complete with air filter, regulator, lubricator and hydraulic pressure gauge, the pump is operable wherever air pressure is available and develops up to 20,000 psi with air at 90 psi. Uses include testing valves, tubing and pressure vessels and supplying power for molding presses.

Circle 6E on reply card

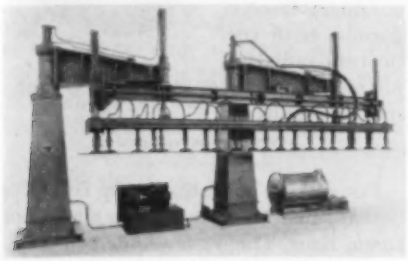
Temco Aircraft Corporation seems to have solved the problem of handling long crates which normally tax both manpower and loading facilities. The company requires packing cases more than 30 feet long and now picks them up with ease with one lift truck and the aid of a chain harness devised by J. R. Yarborough, the firm's shipping inspector. The harness consists of two 8x8-inch scrap-steel plates and of two lengths of ¾-link trace chain, a long one linked by a metal ring to the shorter section that joins the plates. Welded to the latter are metal points, about ½-inch long, that bite into the wood to prevent the plates from slipping. To transport a 20-foot crate, for example, the lift-truck operator runs the 3- to 4-foot forks un-



der it, fits the plates on to the corners at the far end and fastens the long chain to the truck. Then he tilts his fork lift, and when the harness has been drawn taut and the plate points have become lodged in the wood the crate rises from the ground and is ready to be moved.

Circle 7E on reply card

Normally, it takes a crane to lift heavy loads, but W. S. Rockwell Company has designed and built a machine that is said to pick up 24-foot brass plates weighing 880 pounds and to transfer them a distance of 4½ feet from one table to another. The Unpiler, as it is called, is 30 feet long and 13 feet high and is equipped with a vacuum stacker



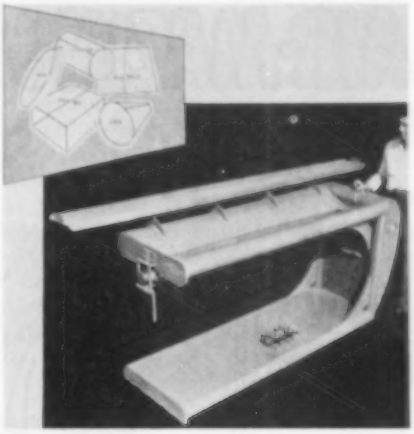
with a pick-up beam 22 feet long. Attached to the latter in a staggered arrangement is a series of suction cups that permit the machine to handle sheets or slabs up to 42 inches wide. The cups are spring-loaded to insure positive grab. Horizontal movement of the beam is effected by two main swinging arms and vertical travel by hydraulic cylinders. The unit can stack three 880-pound plates a minute and is especially useful for handling nonferrous and magnetic materials that are reasonably flat.

Circle 8E on reply card

A rubber-jacketed electric power cable that is said to remain flexible at temperatures as low as –65°F has been developed by Engineer Research & Development Laboratories primarily for arctic conditions but is also suitable for the Tropics.

Circle 9E on reply card

Welding of light-gauge steel, aluminum, titanium, Monel metal, etc., presents a problem of aligning the edges and preventing distortion whether welding is done by hand or automatically. These difficulties are overcome, it is reported, by an unusual type of holding fixture devised by Airline Welding & Engineering. It features two sets of clamping fingers and a flexible hose which, when expanded with compressed air, actuates the fingers and distributes high pressure evenly the entire length of the edges to be joined. The hose is backed up by a copper bar that slides into a machined groove in a mandrel. Metal ranging in thickness from 0.005 to 1 inch can be welded without changing the mandrel, which can be rotated until the



required back-up bar is in position. The fixture is available in lengths from 2 to 12 feet. It is designed primarily for the production of cylindrical forms from flat sheets or strip, but is suitable for welding open-end cones, ovals and other shapes in a wide range of diameters, lengths and gauges.

Circle 10E on reply card

A new device called Aerosensor makes use of compressed air to measure variations in thickness of sheet material down to five-millionths of an inch. It can be utilized by manufacturers of paper, metal foil, plastics and similar products to check and record thickness continuously while they are being made and

THIS AIR TRAP
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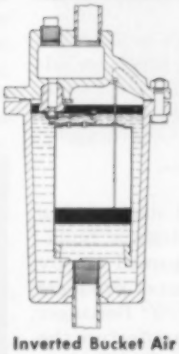
NOW you can get dependable, automatic drainage of water from compressed air intercoolers, aftercoolers, receivers and separators even though the compressor is pumping heavy oil. Any oil reaching Armstrong Inverted Bucket Air Traps collects at the top and is discharged ahead of the water.



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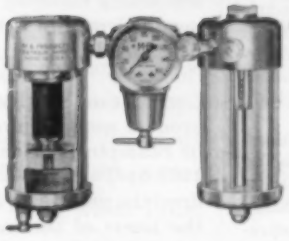

The value of "M-B" Automatic Air Line Filters, Regulators and Lubricators is widely known for their effectiveness as a protection to Air Valves, Cylinders, Pneumatic Tools, etc.

"Your 'Sentinel of the Air Line' has been giving us very good service. We have had no complaints at all and I trust that we will be ordering more of them in the near future."

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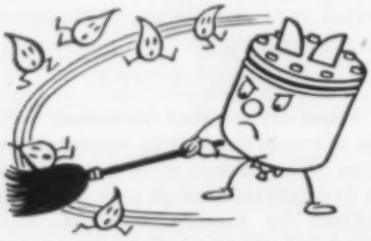
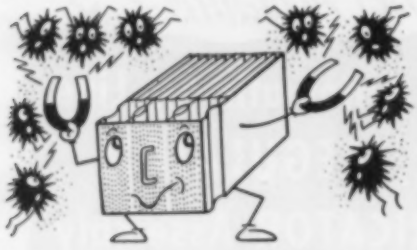
AIR-MAZING FACTS

BY O. SOGLOW

COLD WALLS CATCH DUST! Walls get streaked with dust and dirt if they're only one degree colder than the air in a room. Reason: warmer room air causes dust particles to settle. Experts report cold nail heads and plaster over metal laths are the best dust-catchers.



MOPPING UP OPERATION! Troublesome water never gets through the air lines when compressors are equipped with Air-Maze pipeline filters. A special whirling action traps the water and a cleanable, all-metal filter unit stops dirt and rust, too.



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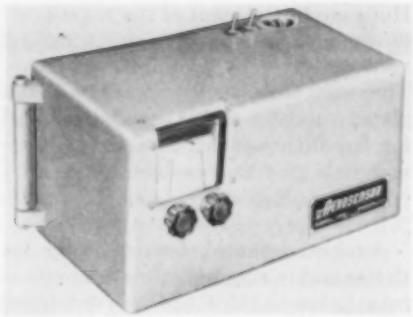
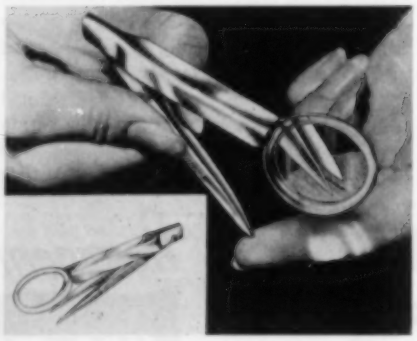


thus eliminate rejections worth large sums. The Aerosensor is a product of Roanwell Corporation.

Circle 11E on reply card

Hilco Engineering Company is the American distributor for a German-made instrument, only 3½ inches long, that combines adjustable tweezers, serrated at the points of contact, with a magnifying glass 1 inch in diameter held in position by a channel arm that also serves as a housing for the tweezers when folded. The latter are riveted to the channel arm, which permits extending



the magnifier from ¼ inch to 2 inches over the tweezer tips for precision adjustment. Both the 4X Miracle Tweezers and arm are made of instrument steel protected by nickel over brass.

Circle 12E on reply card

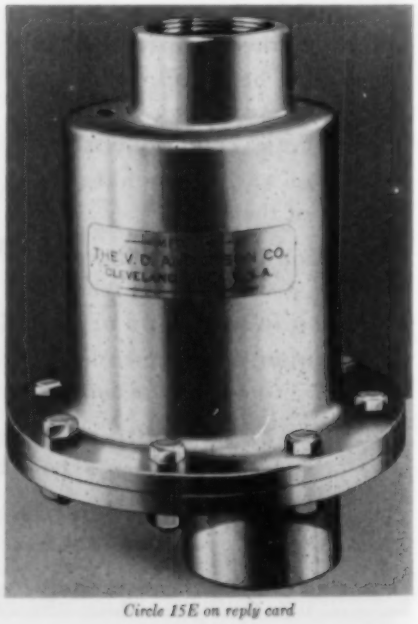
An improved enameled-steel roofing and siding material for industrial buildings and repairs is being turned out by The Toledo Porcelain Enamel Products Company, a subsidiary of Bettinger Corporation. Rights to manufacture the product were acquired from The Republic Stamping & Enameling Company in 1952 by Toledo, which has meantime refined the processing method and changed the name of the material from Vitric-Steel to V-Corr. It is made of corrugated steel, ranging from 18- to 24-gauge, to which porcelain enamel is fused at 1550°F. Nail and bolt holes are driven on the job with portable drills, and nuts are tightened with impact tools. The manufacturer claims that the coating provides complete protection against fire, corrosive gases, steam, smoke, moisture and salt air.

Circle 13E on reply card

Mead's new column press is an adaptable model because it has an adjustable stand that is designed to take either a single- or a double-acting air cylinder with a 3- or a 4-inch bore. The double-acting type shown is provided with an upper ram with a depth stop nut and collar to regulate the stroke from 0 to 36 inches; the single-acting unit has a maximum stroke of 4 inches and the return stroke is effected by an internal spring. The mounting bracket permits both vertical and radial adjustment, and the worktable permits special tooling.

Circle 14E on reply card

For service in plants where corrosive liquids must be drained from air, gas or steam lines, The V. D. Anderson Company is offering a float trap of stainless steel that, according to the manufacturer, automatically and continually discharges the liquid without permitting the gas or steam to escape. The trap mechanism consists of a valve and seat, a lever, and a ball float inside a housing. The liquid enters at the top and raises the float, thus opening the valve and permitting drainage. An accumulation of steam or gas, however, causes the float to drop and close the valve. There is no danger of it seeping out because each trap is given a hydrostatic test after assembly to check the valves, gasket joints and body for tightness. It is designed for 300 psi pressure and a maximum temperature of 800°F.



Circle 15E on reply card

QUOTES

—FROM HERE AND THERE

Listening for Flaws in Rails

"Using principles of wartime land mine detectors, the Pennsylvania Railroad worked out an electronic device that shows up flaws at the juncture of two rail sections, at switches or through paved highway crossings. Operated by a track walker wearing earphones, the machine picks up defects by changing from a high-pitched tone to a growl."

Time, November 9, 1953

Richest Square Mile

"It is claimed that the Golden Mile (at Kalgoorlie, Australia) is the richest square mile in the world. . . payable gold is now being won at levels near 4000 feet. The Golden Mile produces nearly 500,000 fine ounces (of gold) annually. At current prices, gold to the value of $1,008,000,000 has been produced since the field started in 1893.

"Today the Golden Mile is being worked by nine of the largest gold producing companies of West Australia . . . and it is the principal gold mining center for the Commonwealth of Australia."

Mining Congress Journal, December, 1953

Smokeless Zones

"A decision to seek statutory power to declare 'smokeless zones' within the City of London and to prohibit the installation of furnaces in buildings unless they are, as far as practicable, capable of being operated continuously without emitting smoke, was taken by the Court of Common Council on Thursday of last week.

"An appeal to local authorities to join more actively in the campaign against smoke was made in his retiring presidential address by Prof. F. E. Tylecote, of Manchester, when the annual conference of the National Smoke Abatement Society opened in Glasgow. In a review of smokeless zones, Dr. T. Morrison Clayton, Medical Officer of Health for Coventry, said that his city, which had been the first to establish a smokeless zone, was now preparing to double its size."

Iron & Coal Trades Review, London, October 2, 1953

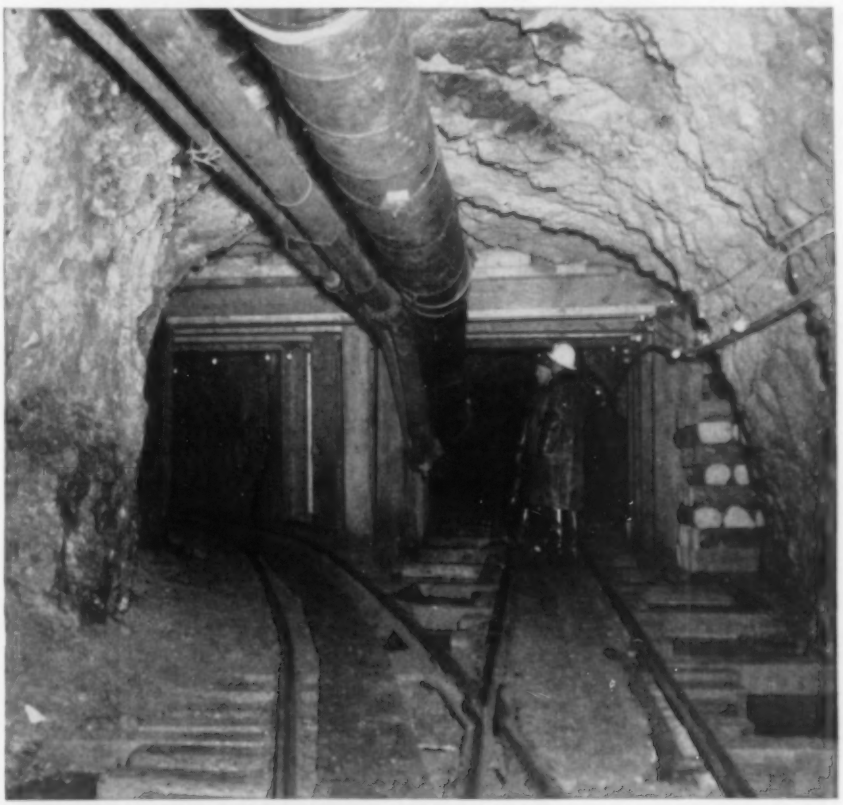
Air Tools and Mine Ventilation

"Compressed air equipment is used extensively in some anthracite and metal mines for mining and transportation. Experience proves that compressed air reaches the workings at a temperature which is, for all practical purposes, the same as that of the ventilating air. When the compressed air expands to produce driving energy, the air is discharged from the machines which it has set in operation at a lower temperature than that of the surrounding atmosphere and it can thus produce a certain amount of local cooling effect. However, the work done by the machines operated by compressed air consists as a rule either of percussive or frictional movements, whose heating effect is exactly equivalent to the cooling effect produced. . . .

"It is therefore impossible to attribute any cooling effect at the face to the expansion of compressed air. The only exception to this rule would be where the air is used as the motive power in an appliance intended to overcome the effect of gravity.

"Nevertheless, if all compressed air equipment were replaced by electrically driven apparatus, the percussive and frictional work remaining the same would no longer be compensated by the cooling effect of the expanding compressed air and it would be necessary to enter in the thermal balance sheet of the face the calorific equivalent of the total amount of electric current used, which may constitute a significant item."

Mining Congress Journal, December, 1953



It's no problem to take along the air you need for underground operations. Naylor pipe makes it an easy matter to "take it with you". This distinctive light-weight pipe is easy to handle and install — particularly when you use Naylor Wedge-Lock couplings to assemble the line. Sizes range from 4" to 30" in diameter to take care of any push-pull ventilating requirements. Naylor pipe is also made for "high air" and water lines.

Write for Bulletin No. 507 on line pipe and Bulletin No. 514 on Wedge-Lock couplings for vent pipe service.

NAYLOR PIPE

Naylor Pipe Company • 1245 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Circle 17A on reply card

Books and Industrial Literature

Henley's Twentieth Century Book of Formulas, Processes and Trade Secrets has appeared in revised form with new sections on plastics and photography. A reference book of 900 pages for amateurs and professionals, it contains nearly 10,000 selected household, workshop and scientific formulas, trade secrets, chemical recipes, processes and money-saving ideas. In addition to a buyer's guide and subject index, it includes a list of common names of various chemicals and information on workshop and laboratory methods. The book was edited and revised by Gardner D. Hiscox and Prof. T. O'Conor Sloane, and the chapter on photography was written by Carlyle F. Trevelyan, faculty member of the New York School of Modern Photography. Published by The Norman W. Henley Publishing Company, 254 W. 54th Street, New York 19, N. Y. Price $4.00.

Railway Maintenance Corporation has published a new illustrated bulletin containing detailed information on five McWilliams track-maintenance machines: the tie tamper, ballast distributor, crib cleaner and ballast-cleaning mole and supermole.

Circle 16E on reply card

The DoAll Company is offering a 16-page bulletin on its complete line of cutters for milling machines and accessories such as end mill holders and arbors. At the back of the book is helpful information on the proper application of cutters and saws and a table of recommended cutting speeds.

Circle 17E on reply card

Ingersoll-Rand Company's complete line of floor-mounted direct-contact barometric condensers for food, process, pharmaceutical and chemical industries is described in Bulletin 9041 now available. Fully equipped, these units are ready for operation by connecting them to water and electric lines and can be installed near the processing equipment because a Motorpump is used in place of the usual long barometric leg to remove the spent condensing water from the bottom reservoir. Literature includes installation views and cut-away sections showing the vapor and condensing-water flow.

Circle 18E on reply card

Barksdale Valves has released a 20-page catalogue, 3G, which describes and illustrates its full line of pressure switches and Shear-Seal valves (manual and solenoid) for the control of vacuum or pressures up to 6000 psi.

Circle 19E on reply card

Foundries that have difficulties with cores may avail themselves of the technical services and laboratory facilities of the Pelron Corporation, maker of core oils, pastes, washers and binders that are dealt with in an available bulletin.

Circle 20E on reply card

Standard Pressed Steel Company offers a bulletin on its heat-treated Unbrako Dryseal-Thread Pressure Plugs that seal tight against liquids or gases under pressure without a sealing compound by crushing crests and roots in softer threads of mating parts.

Circle 21E on reply card

An illustrated 12-page circular, No. 502, has been prepared by The Lunkenheimer Company on its pop safety valves for steam and gases and its relief valves for water, oil and other liquids. In addition to data on their uses, installation and operation, it contains valuable information in the form of steam, air and gas relieving capacity tables, as well as multipliers for computing those capacities.

Circle 22E on reply card

Catalogue No. 30 recently released by Metal Removal Company deals with its porcelain- and resinoid-bonded mounted grinding wheels and serves users as a guide in selecting the shape best suited for a given job. Mandrels and rubber polishing wheels also are listed and illustrated.

Circle 23E on reply card

The 1954 edition of General Electric Company's catalogue—GEC 1005E—on its Calrod electric heaters and heating devices is now ready for distribution. Of 60 pages, it illustrates and describes the units in terms of application and also gives methods of determining their power requirements and heat losses in varied services.

Circle 24E on reply card

Corrugated Industrial Roofing and Siding is the title of a 16-page illustrated booklet published by Aluminum Company of America. In addition to describing methods of application simplified by drawings, it discusses fasteners, flashing, ridge rolls and closure strips and gives loading, weight and coverage tables. Also included is information on how to construct an insulated aluminum industrial wall.

Circle 25E on reply card

The new 42-page Wheelco data book and catalogue, TC-10, is offered to anyone interested in solving process control problems. It shows a complete line of thermocouples, radiation detectors, and resistance bulbs; gives information on sensing units as well as tips on instrument servicing; and includes data on protection tubes, lead wire and other accessories for use with indicating, controlling and recording instruments.

Circle 26E on reply card

A 24-page brochure covering engineering and construction activities of Fluor Corporation, Ltd., in the chemical, petroleum and petrochemical fields is being distributed without charge. Gasoline plants, refineries, catalytic cracking units and compressor stations are described and illustrated, as well as cooling towers, heat exchangers, heavy-duty mufflers, pulsation dampeners and gas cleaners.

Circle 27E on reply card

In a 6-page folder, American Silver Company, Inc., discusses its wide variety of thin-gauge and close-tolerance ferrous, nonferrous and precious-metal strip material now available to industry in any desired quantity. Of interest to product designers, materials engineers and purchasing agents is a list of thickness tolerances of its beryllium copper-alloy strip, the first in a series of such lists on the metals produced by the company.

Circle 28E on reply card

An illustrated catalogue announced by Cast Optics Corporation describes and lists the numerous applications of its clear, cast thermoset Cocor (plastic) sheets. Comparable to plate glass in smoothness, the material is said to be tough and highly resistant to abrasion, heat and chemical solvents. Catalogue and samples are available upon request. The company is equipped to help manufacturers with their plastics problems.

Circle 29E on reply card

only a
SAUERMAN SCRAPER
can give you this bulk
storage economy . . .

Above scraper stocks out and reclaims incoming ilmenite ore for processing operations. Equipped with a monorail and trolley system for rapid-shifting the Sauerman Scraper Storage machine was selected to achieve profitable low-cost material handling. The Scraper, a ¾-cu. yd. Crescent heavyweight is controlled by a single operator in a safe location above the storage area.

Write for Catalog E, Bulk Storage by Scraper

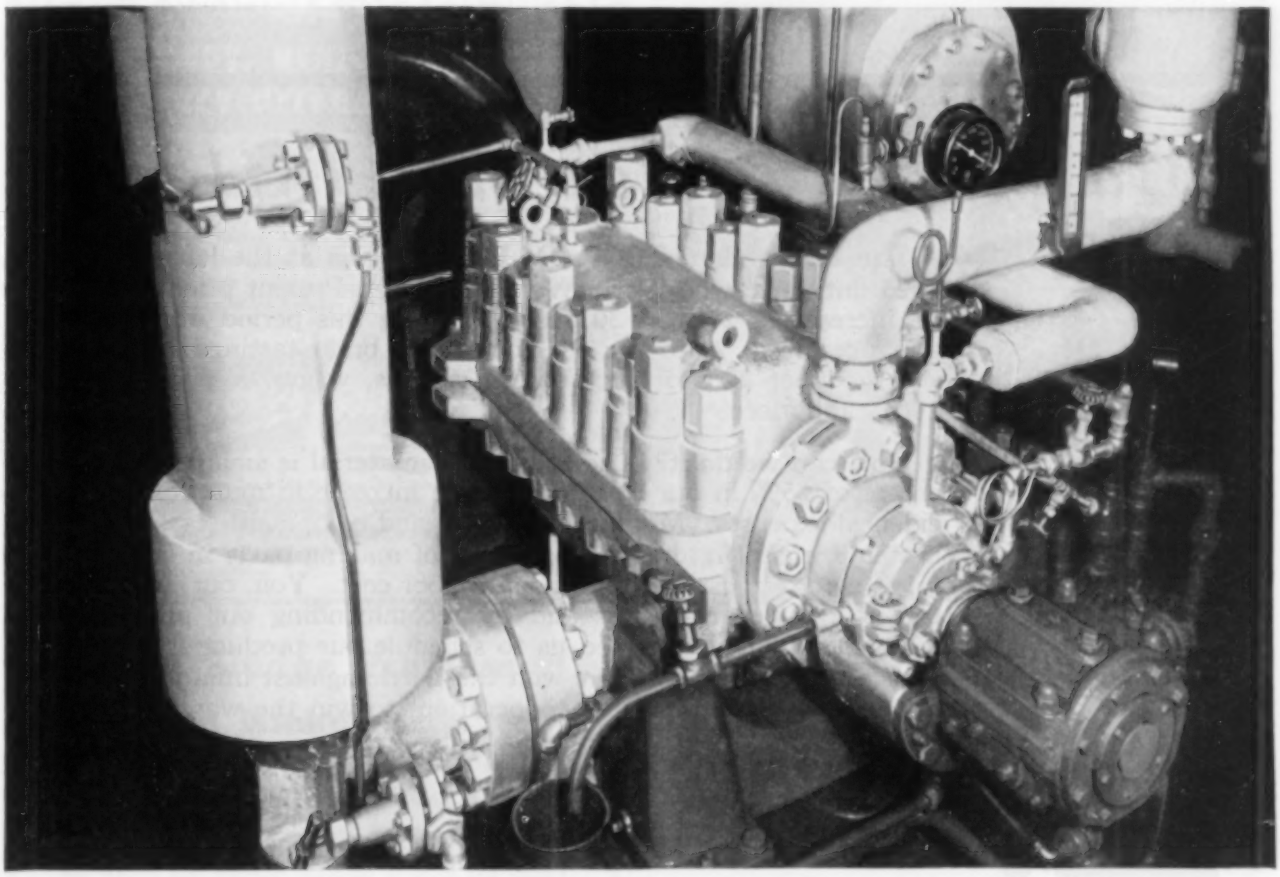
548 S. Clinton St. **Chicago 7, Ill.**

SAUERMAN BROS., Inc.

Circle 18A on reply card

100,000 HOURS

and not opened yet!



This Ingersoll-Rand High Pressure Boiler Feed Pump installed 15 years ago has never been opened for inspection . . . and it still meets capacity and pressure requirements.

The Ingersoll-Rand Class HT pump shown above was installed in 1938 at the Windsor Station, owned jointly by The Ohio Power Company (part of the American Gas & Electric Company) and the West Penn Power Company (in the West Penn Electric Company system). Since that time, it has operated for over 100,000 hours—pumping 1025 gpm of 380° F boiler feed water at 415 psi intake and 1900 psi discharge. Throughout this entire 15 year period, the casing and high pressure breakdown have never been opened for inspection.

There are five other I-R Class HT pumps at this station. Four of these have chalked up unopened service records of from 50,000 to 80,000 hours each.

These outstanding operating records are the result of competent pump operation and feedwater control on the part of the station's personnel—and the careful material selection and high standards of construction inherent in every I-R boiler feed pump.

For *proved dependability* in high pressure service, it pays to specify Ingersoll-Rand pumps.

Ingersoll-Rand

Cameron Pump Division
11 Broadway, New York 4, N. Y.

948-10

ROCK DRILLS • COMPRESSORS • AIR & ELECTRIC TOOLS • VACUUM EQUIPMENT • PUMPS • GAS & DIESEL ENGINES

NON-SEIZING AND NON-SCORING*
RESISTANT TO HEAT, SHOCK, GRIT.
➔ SELF-LUBRICATING

*U. S. Govt. report states " . . . will not . . . melt like babbitt, or freeze on the shaft like bronze".

BEARIUM METAL

COMBINES BEST BEARING FEATURES OF BOTH BABBITT AND BRONZE

By an exclusive process, *minute lubricating lead globules are evenly distributed throughout the bronze matrix.* The resulting unusual frictional properties of *Bearium Metal* have steadily increased its use for tough bearing problems everywhere . . . from motion picture projectors to power shovels . . . from high-speed machine tools to blooming mills . . . from compressors and Diesels to rock crushers.

Write for Full Information on this Amazing Bearing Alloy

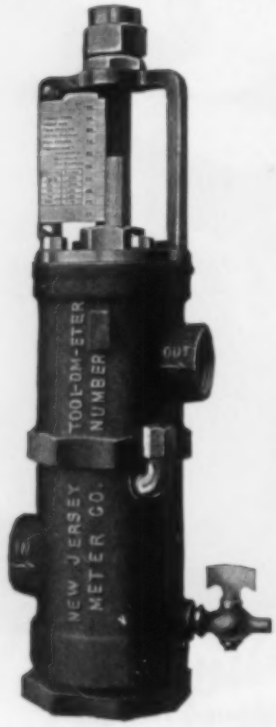
BEARIUM METALS CORP. 270 STATE STREET Rochester 14, N. Y.

WEST COAST AFFILIATE:
Nevin Engineering Associates
932 Chautauqua Blvd.
Pacific Palisades, Calif.

IN CANADA:
Bearium Metals of Canada, Ltd.
155 George St.
Toronto 2, Canada

Circle 20A on reply card

Hold the Line against Inflation



The 1" Standard TOOL-OM-ETER shown at the left sold from 1923 until after the World War for $60.00. Present price is $75.00, an increase of 25% in 30 years. During this period iron castings advanced from 7c to 21c per pound; red brass castings 26c to 75c; sheet copper 22c to 55c; freight, express, wages, and incidentals, 100% and more.

How can we do it? The tonnage of material is small and the increase of 25% in our price covers the increase in materials and incidental expenses. Modern machinery and equipment, carbide tools, better jigs and fixtures, and a policy of making parts in larger lots, takes care of most of the increased labor cost. You, our loyal customers, by repeat orders and by recommending our products to your friends, have enabled us to schedule our production in larger lots. We feel that we have won the battle against inflation and we hope, with your continued cooperation, to win the war.

Thank you.

Do you want Bulletin A-7 on Air Meters?

Bulletin D-A on the DriAir Separator?

NEW JERSEY METER CO. PLAINFIELD, N. J.

"SPECIALISTS IN COMPRESSED AIR DEVICES"

Circle 21A on reply card

TWO HANDY REFERENCE BOOKS

for

THE ENGINEER, THE SUPERINTENDENT, THE OPERATING MAN

CAMERON PUMP OPERATORS' DATA (Second Edition): Contains practical information covering the installation, operation and maintenance of centrifugal pumps.

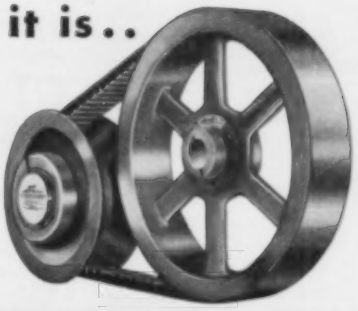
CAMERON HYDRAULIC DATA (Twelfth Edition): Covers data useful in work involving the handling of liquids, steam, and water vapors.

Cameron Pump Operator's Data $2.00
Cameron Hydraulic Data $3.00

Both books can be obtained at the combination price of $4.50.

COMPRESSED AIR MAGAZINE, 942 MEMORIAL PARKWAY
Phillipsburg, New Jersey, U.S.A.

here it is..



New VARIABLE SPEED DRIVE
an easy, economical way to vary driven speed

By simply turning an adjusting screw, on either side of the sheave, both flanges move simultaneously and speed changes are obtained quickly and easily. Positive clamping of the two adjustable flanges eliminates fretting corrosion. Single wide range belt for motors 5 to 20 horsepower provides speed range ratios up to 3 to 1 . . . no lubrication . . . less shaft overhang . . . sensibly priced and economical in operation . . . send for Bulletin #796 for detailed information.

T. B. Wood's SONS COMPANY

CHAMBERSBURG, PA.

Mechanical Power Transmission Manufacturers—Since 1857.

CAMBRIDGE, MASS. • NEWARK, N. J. • DALLAS, TEXAS • CLEVELAND, O.

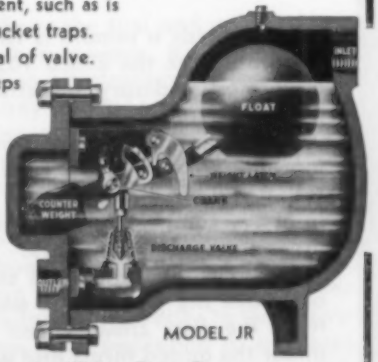
Circle 22A on reply card

Solve Sludge Problem with Nicholson's *New* AIR TRAPS

With the introduction of an exclusive new oil-eliminating feature that prevents build-up of scum and sludge, Nicholson air traps now enable you to enjoy the advantages of the positive intermittent action of a float-operated air trap without the common problem of oil congealing on the mechanism and impeding or stopping its action. Other features of Nicholson air traps:

1) No air-wasting vent, such as is in all inverted bucket traps.
2) Positive water seal of valve.
3) Large orifice keeps valve clean, preventing blow-through. Three types; pressures to 1500 lbs. For details send for

CATALOG 953



MODEL JR

180 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Circle 23A on reply card

Something New... FOR YOUR TOUGHEST DRILLING JOBS!

"HARDROK"
Wire Braid AIR HOSE

Assurance of longer service life, with consequently lower replacement costs, recommends "HARDROK" wherever severest drilling conditions call for a truly **super-strong** air hose.

The carcass is made of horizontally braided steel wires, providing exceptional strength, durability and resistance to kinking, without impairing flexibility. The long-lasting Synplastic tube is impervious to the action of oil from the drill. The cover is a tough, wear-resistant yellow rubber compound. A black spiral stripe gives the hose a distinctive appearance for easy identification. Sizes ½" to 2", inclusive.

Contact Our Nearest Branch for Details and Prices

GOODALL RUBBER COMPANY

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

Branches: Philadelphia • New York • Boston • Pittsburgh • Indianapolis • Chicago • Detroit • St. Paul • Los Angeles • San Francisco • Seattle • Spokane • Portland • Salt Lake City • Denver • Houston • Goodall Rubber Company of Canada, Ltd., Toronto • Distributors in Other Principal Cities

Est. 1870

Circle 24A on reply card

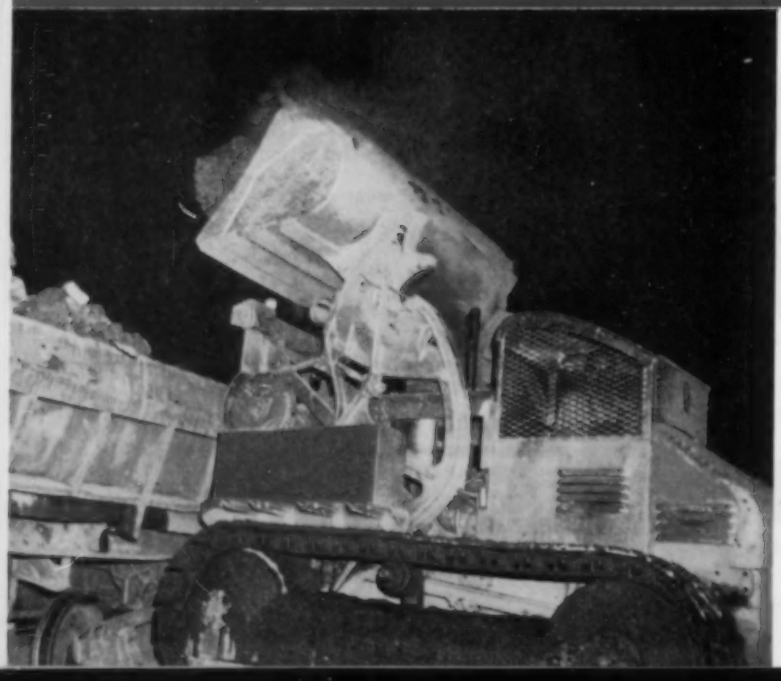
EIMCO

WORLD'S FINEST TRACTOR EXCAVATOR

Hot slag, brick and debris tumbled down in this steel mill open hearth slag pocket to clear the way for furnace relining above. This mass of molten white hot metals and slag along with brick and refractories must be cleaned up quickly — the furnace is out of production until this job is complete.

This is considered one of the toughest kind of loading jobs —it incorporates digging, excavating, prying and loading under intense heat conditions. Previously several types of equipment were used — each for a special function. Now the 105, shown above, is able to replace two or more of these pieces of equipment, speed up the job and get the pocket cleared in record time.

The Eimco 105 picks up the white hot material, ranging in size to 5 or 7 tons, and dumps it overhead into a railroad gondola. (See below.)

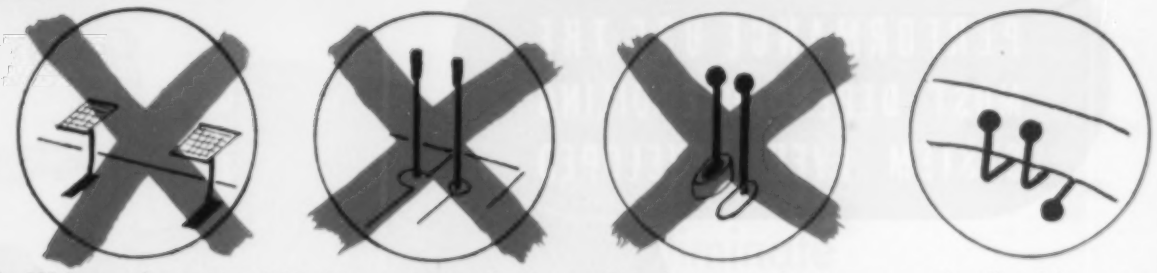


Nine yards a minute is fast loading, and you can do it with the Eimco 105. You can dig and load most ordinary materials without preliminary breakage.

The Eimco 105 is primarily an excavating machine with ability to load consolidated material. It will handle many jobs previously assigned to heavy cumbersome machinery costing several times the price of the 105.

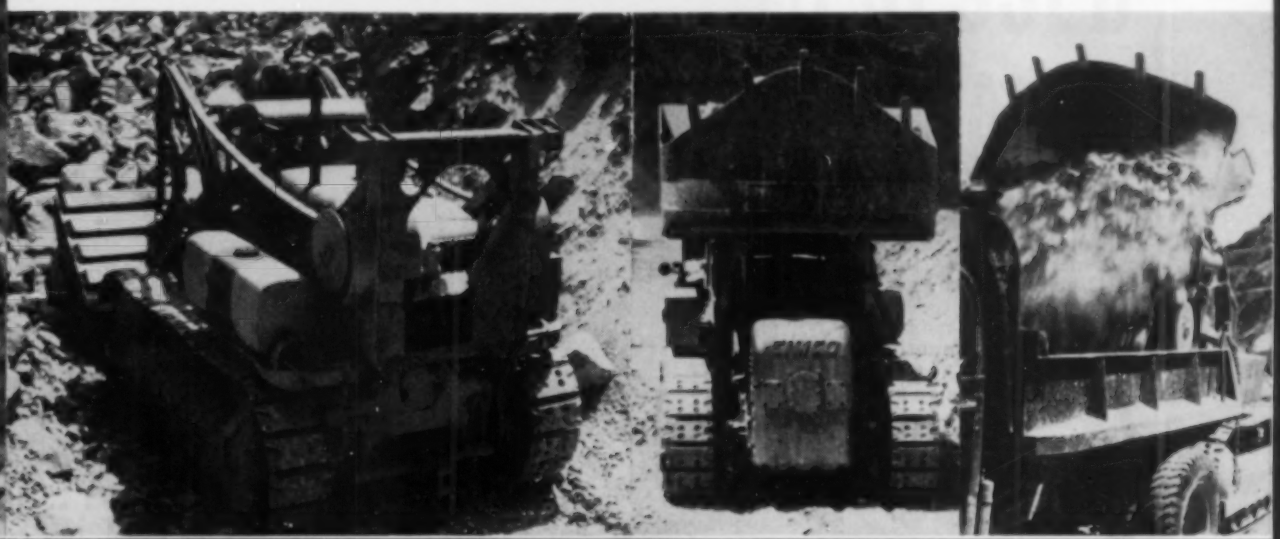
Steel castings and steel construction throughout make the 105 rugged and dependable. It is truly the first crawler unit designed to work under the added thrust and weight loads applied by the numerous attachments now available for contractors and industry that are accepted as part of the prime movers they buy. Its all steel construction makes it resist breakage from impact or abrasion which all machines encounter in normal working.

WITH COST SAVING ADVANTAGES



The 105 is a modern tractor, designed to meet the needs of modern, up-to-date machinery users. The need of clutch pedals has been eliminated, the use of steering brakes has been removed and the need for shifting transmissions by hand is no more. The Eimco 105 works smoothly and efficiently with two small levers which control the tracks on their respective sides. The 105 may be shifted from forward to reverse independently on either track with no clutching — no shifting. Turns can be accomplished by twisting one lever to forward position and the other to reverse to provide spin turns, or longer turns can be effected by proper manipulation of these same handles. Gear changing is done with a separate small handle which may be actuated at any time during the operation of the machine.

The cycle of the loading unit is fast (see below) — digging or excavating is forward, discharge is overhead to the rear. Complete cycles from digging position to digging position average 10 to 15 seconds, which will permit loading of 6 to 9 yards per minute depending on material being loaded and travel distance.

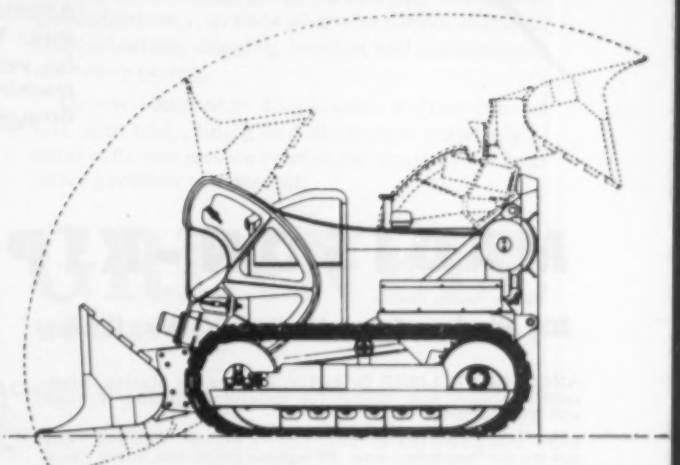


THE EIMCO CORPORATION
Salt Lake City, Utah, U.S.A.
Export Office: Eimco Bldg., 52 South St., New York City

8-7

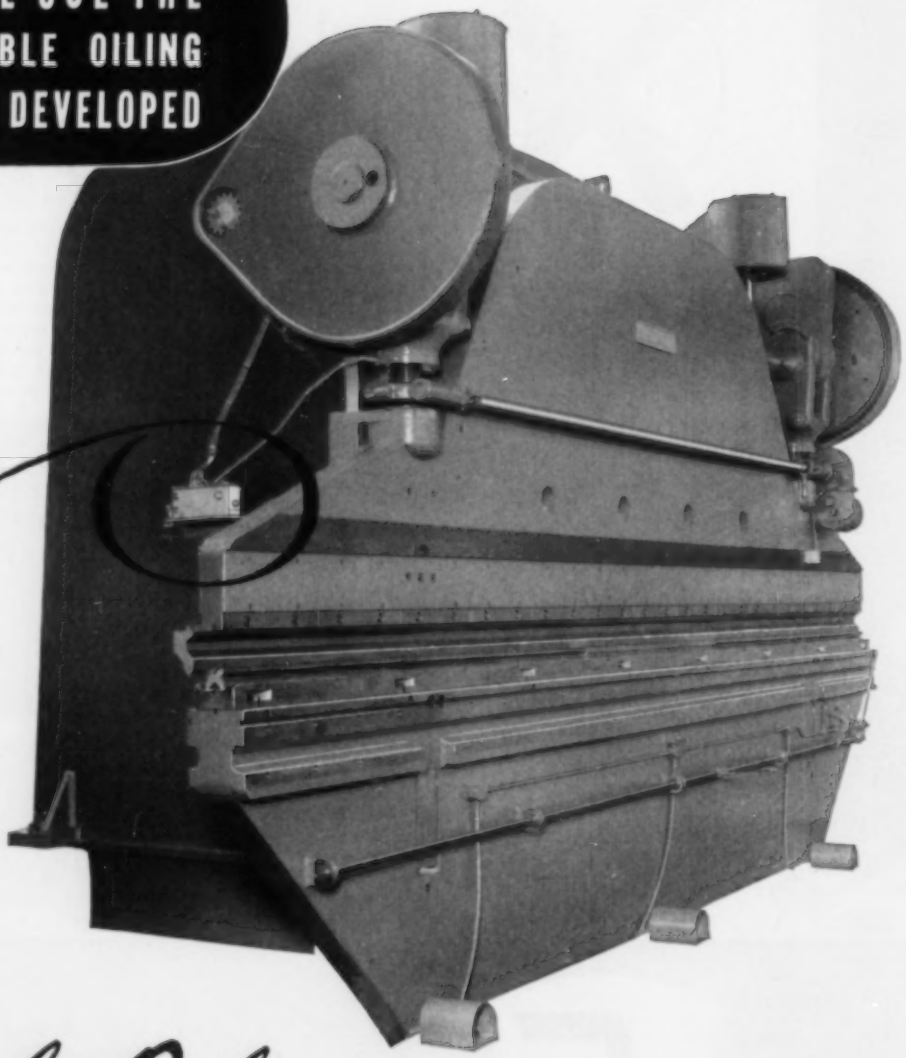
With the 105 you have the first and only truly modern crawler type unit for heavy work. It's fast. It needs only a minimum of attention. It requires the least in physical operating effort of any machine of its type. It will do many things that no other machine will do; and if mechanical attention is ever necessary, its various units are designed for easy accessibility so that the work to be done can be finished in only a fraction of the time required for a similar repair on any other prime mover.

Let us tell you about this machine: where the driver sits up front and can see what he's doing, where the loading equipment is fastened directly to the heavy main frame permitting free track oscillation at all times, that allows for speed changing under full power and load without sacrificing any advantage, that gives you a drawbar pull in the big class with a price in the small class, and many more exclusive advantages. Just write: The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah.



Rocker-arm loading action provides fast, efficient loading. Bucket shown in the digging, carry and discharge positions pictured above.

MACHINES OF GREAT PERFORMANCE USE THE MOST DEPENDABLE OILING SYSTEM EVER DEVELOPED



Illustrated is Madison-Kipp Lubricator Model FD installed as original equipment on a 3/8" by 20' Cincinnati Press Brake, manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio.

MADISON-KIPP

fresh Oil . . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

MADISON-KIPP CORPORATION

202 Waubesa Street, Madison 10, Wis., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marias, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

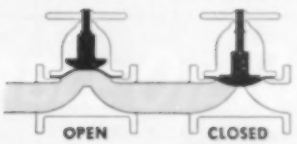
WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS

Circle 26A on reply card

The valve originally designed to eliminate

COMPRESSED AIR LEAKS



Features which have made Grinnell-Saunders Diaphragm Valves the specified valve in many different industries:

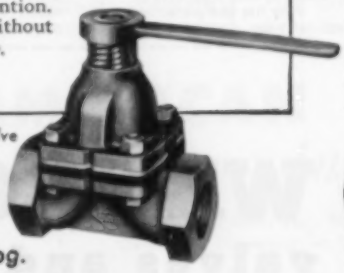
Streamlined flow. Smooth, streamlined passage, without pockets, prevents trapping of solids. Frictional resistance is at a minimum — regardless of direction of fluid flow. No disc holder in fluid stream.

Leak-tight closure against grit, scale, suspended solids. The resilient diaphragm, plus the large area of contact, gives leak-tight closure against pressure or vacuum.

Working parts absolutely isolated from fluid. Diaphragm completely seals off working parts from fluid in the line. No sticking, clogging or corroding of working parts. Valve lubricant cannot contaminate fluids.

Body, lining and diaphragm materials to meet service condition. Bodies stocked in cast iron, malleable iron, stainless steel, bronze and aluminum; other materials on special orders. Valve bodies lined with lead, glass, natural rubber or neoprene. Diaphragm materials of natural rubber or synthetics.

Minimum maintenance. No refacing or reseating is required. No packing glands to demand attention. New diaphragm can be inserted without removing valve body from the line.



Quick Operating Valve

Write for Grinnell-Saunders Diaphragm Valve Catalog.

A single 1/32-inch leak in an air valve can waste, in one month, the full cost of a Grinnell-Saunders Diaphragm Valve. In fact, that's why Grinnell-Saunders Diaphragm Valves were designed . . . to eliminate costly air leaks. Even when scale in the line becomes lodged on the valve weir, Grinnell-Saunders Valves give positive, air-tight closure.

The operating principle is simple. A rubber diaphragm, seating on metal, makes possible an absolute seal. At the same time, because working parts are wholly isolated, no packing glands are necessary, and stem leaks are impossible.

Successful on compressed air lines, it was only a matter of time before Grinnell-Saunders Diaphragm Valves were in demand for other type installations . . . handling materials as diversified as corrosive fluids, gases, beverages, foods, suspended solids . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

Grinnell-Saunders Diaphragm Valves can be had with body, lining and diaphragm materials to meet different service conditions. Assign your next valve problem to Grinnell.

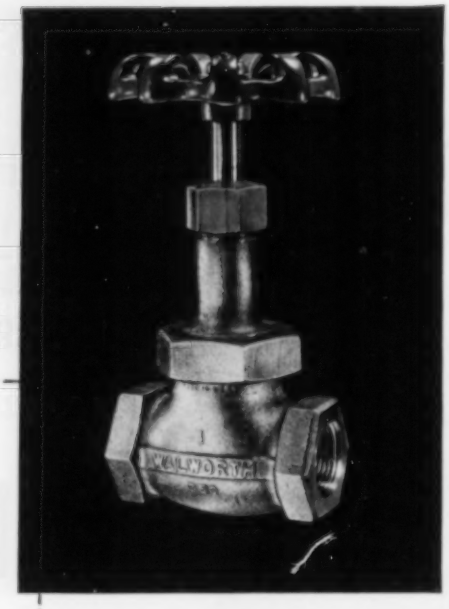
GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

Circle 27A on reply card



take a good look at the Walworth "500 Brinell" no. 225P Globe

IDENTIFICATION DISC: An aluminum marking plate on all Walworth No. 225P's facilitates inventory control and makes reordering quick and positive.

NEWLY DESIGNED HANDWHEEL: Patented air-cooled, finger-fit handwheel affords sure grip even with greasy gloves.

IMPROVED PACKING: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure when fully opened.

– the Toughest Bronze Valve Your Money Can Buy

The stainless steel, corrosion resistant seats and discs are heat treated to a hardness of 500 Brinell – hard enough to scratch glass and crush nails! The valve can be closed on sand, slag, and pipe scale without injury to the seating surfaces. "Wire drawing" is practically eliminated. All parts are accurately machined and gaged. Years of tight, positive shut-off are assured.

Available in both globe and angle types (angle type: No. 227P) in sizes ¼" to 2", this quality valve is recommended for 350 lbs. W.S.P. at 550 F, and 1000 lbs. non-shock service on cold water, oil, gas, or air.

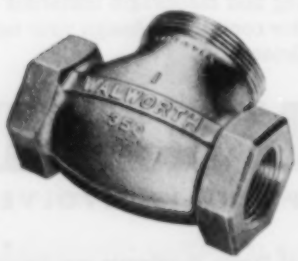
For full data on this long-life, economical Walworth Bronze Valve, see your local Walworth distributor, or write for Circular.

note these 7 Great Features

HEXAGONAL UNION BONNET CONNECTION, DEEP STUFFING BOX AND RUGGED STUFFING NUT: Union bonnet connection eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and reassembled.

OVERSIZE STEM: The high-tensile strength silicon-bronze stem assures long life and protection against wear.

SEATS AND DISCS: Plug type seats and discs of stainless steel, heat-treated to 500 Brinell hardness and machined simultaneously to a mirror-like finish, with accurate tapers assures tight positive shut-off with minimum handwheel effort.



EXTRA STRONG BODY: Made of Composition M (ASTM B61) bronze. Thick walls and rugged hexes provide a high safety factor. Valves undergo hydrostatic shell test of 1,000 psi.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Circle 28A on reply card

Typical installation of American Hammered Conformable Oil Rings

AMERICAN HAMMERED CONFORMABLE OIL RING

Insures constant unit pressure for positive oil control!

You keep your oil consumption down when you install Koppers American Hammered Conformable Oil Rings! This service-tested piston ring conforms readily to meet cylinder distortion because its flexible cast iron member is pressed outward by an abutment type spring which exerts uniform radial pressure around the entire circumference.

Narrow bearing surfaces on either side of the channel give the ring a uniform unit pressure on the cylinder, enabling it to seat promptly and assuring maximum removal of excess oil throughout its lifetime. And the Conformable Oil Ring has a longer useful life because its low spring rate and uniform lands result in negligible changes in pressure as the ring wears

Easily installed, it is ideal for both 2-cycle and 4-cycle Diesel & Gas engines; comes in 4″ to 25″ diameters with a minimum width of ¼″. Write, wire or phone us today for full information on how the Conformable Oil Ring can improve *your* operation . . . or for expert help in *any* piston or sealing ring problem. KOPPERS COMPANY, INC., *Piston Ring Dept.*, 1512 Hamburg Street, Baltimore 3, Maryland.

KOPPERS®

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • Baltimore, Maryland

This Koppers Division also supplies industry with Fast's Couplings, Aeromaster Fans, Koppers-Elex Electrostatic Precipitators and Gas Apparatus.

Engineered Products Sold with *Service*

AMERICAN HAMMERED *Industrial Piston Rings*

KOPPERS COMPANY, INC., *Piston Ring Dept.*, 1512 Hamburg Street, Baltimore 3, Md.

Gentlemen: Please send me full information on your Conformable Oil Ring.

Name.....

Company.....

Address.....

City.....Zone..... State.....

Circle 29A on reply card

POSITIVE DUST PROTECTION

for Small Engines and Compressors

NEW AMERICAN TYPE FS INTAKE AIR FILTER NOW AVAILABLE IN 50 TO 800 CFM CAPACITY RANGE.

Clean air is no longer reserved just for the "big boys"! The new American Type FS filter was designed with only one group in mind—those small stationary and portable engines and compressors of 50 to 800 cfm capacity.

Starting from "scratch", AAF engineers have built into the Type FS the five filter features essential for this service—(1) high cleaning efficiency, (2) large dust holding capacity, (3) easy maintenance, (4) simple installation *in any position or location,* (5) inexpensive media replacement.

Filtering Media "Combat Proved"

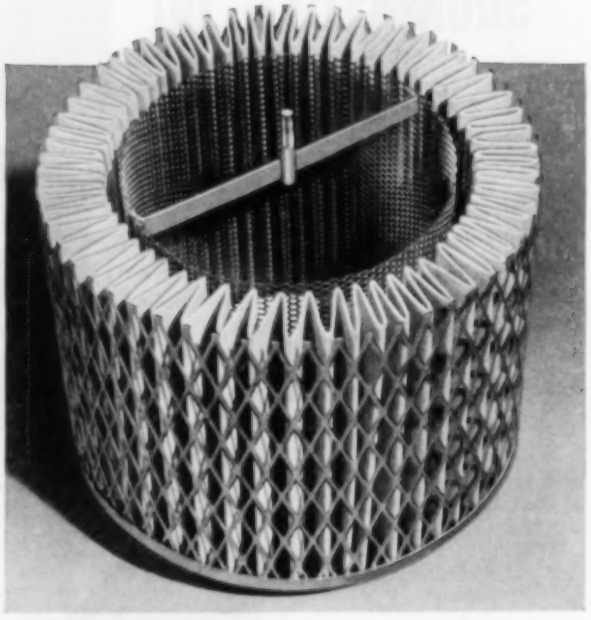
The filtering media used in the Type FS is a rayon flock—the same as selected for combat plane carburetor intake filters because of its light weight and efficient dust removal. The flock, which is bonded on a galvanized woven screen, may be cleaned quickly by washing in gasoline or any other solvent.

Operates Either Dry or Oilcoated

The Type FS may be operated either dry or oilcoated. When oiled its high cleaning efficiency is comparable to that of the dry filter and its dust holding capacity equal to that of a viscous type filter.

Uniform Efficiency

Whether operated oiled or dry, the Type FS filter's efficiency in dust removal is uniform over its entire life. With cleaning efficiency constant, full protection is assured at all times.



View of a Type FS filter with top section removed. The flocked screen filtering media is accordion pleated to provide maximum surface area. Inner perforated screen baffle serves to equalize air flow and protect against backfire.

Available in 7 Sizes

The Type FS is made in seven sizes, giving a capacity range from 50 to 800 cfm. A weather shield is available for outdoor installation as protection against rain and snow.

Write today for Bulletin No. 135 containing complete data on the new American Type FS—the filter for small engines and compressors with a big capacity for work.

AAF

American Air Filter

COMPANY, INC.

402 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

Circle 30A on reply card

He Knows!

EXPERIENCE is the truest guide to production efficiency and economy... and experience in the excavating and construction fields proves that Roebling wire rope is your one top choice for avoiding delays, cutting down replacements and saving wire rope dollars.

All over the country, large numbers of experienced wire rope users definitely prefer Roebling wire rope. Call your nearest Roebling office or distributor for a Roebling recommendation.

ROEBLING
A subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

Circle 31A on reply card

24 ACRES *Cover the World*

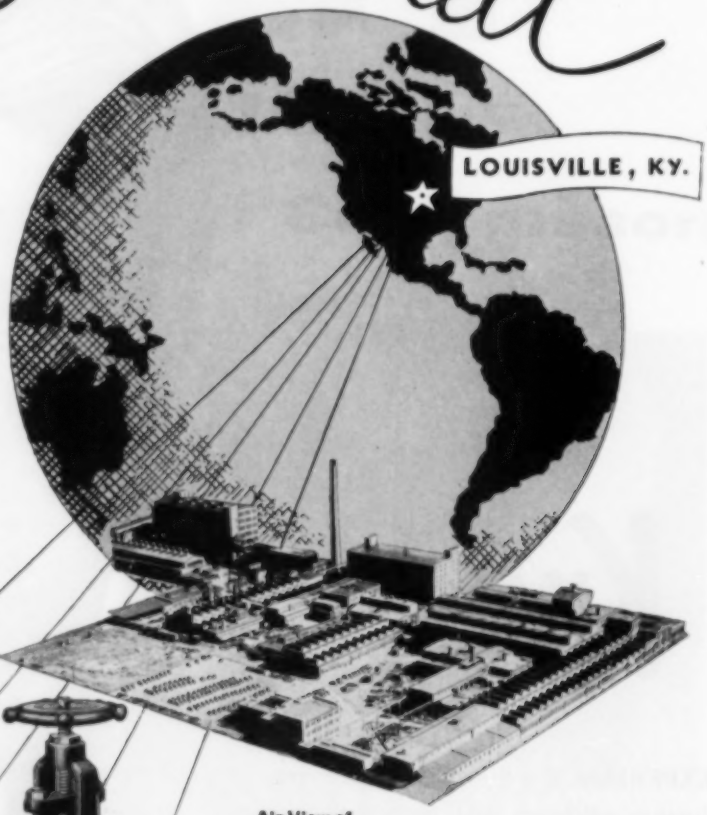
. . . with TOP QUALITY

DROP FORGED STEEL

VALVES, FITTINGS and FLANGES

by

Vogt



Air View of
Henry Vogt Machine Co.

This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

OUR COMPLETE LINE INCLUDES

Flanged, Screwed and Socket Weld End Globe, Gate and Check Valves • Ells, Tees and Crosses • Couplings • Bushings • Plugs • Unions • Flanges and Flange Unions • Welding Heads

HENRY VOGT MACHINE CO. LOUISVILLE 10, KY.

Branch Offices: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

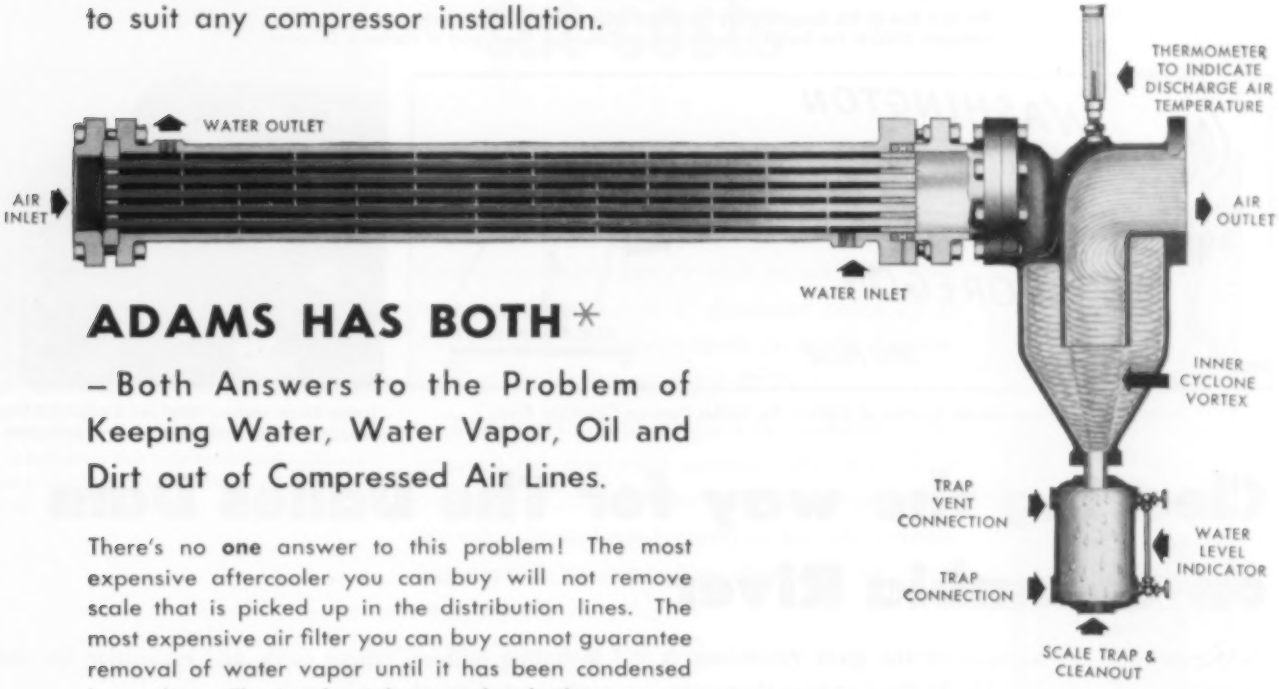
Circle 32A on reply card

LOSING MONEY ON WET, DIRTY AIR?

Rx SEE A SPECIALIST!

ADAMS Aftercoolers are specially designed equipment with prices and delivery that are standardized to save.

Select your aftercooler, either for a new installation or a replacement, strictly on its merits and you will choose Adams. Specifications to suit any compressor installation.



ADAMS HAS BOTH *

– Both Answers to the Problem of Keeping Water, Water Vapor, Oil and Dirt out of Compressed Air Lines.

There's no **one** answer to this problem! The most expensive aftercooler you can buy will not remove scale that is picked up in the distribution lines. The most expensive air filter you can buy cannot guarantee removal of water vapor until it has been condensed by cooling. That's why Adams makes both.

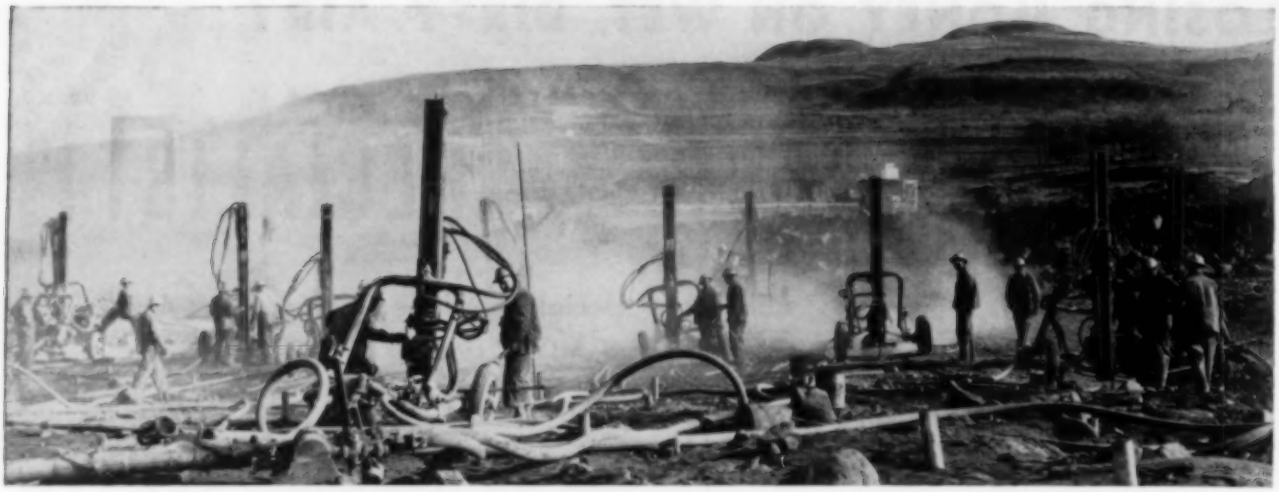
*PORO-STONE AIR FILTER

1. Centrifugal separation of dirt and liquids.
2. Drainage to trap directed by vertical cast-in slots.
3. Continuous, fully automatic trap action.
4. Rapid diffusion and filtration through permanent, cleanable Poro-Stone.
5. Clean, dry air at practically unchanged pressure. Standard, stocked sizes handle from 10 to 700 cfm.
6. Easily installed in either vertical or horizontal pipe line.

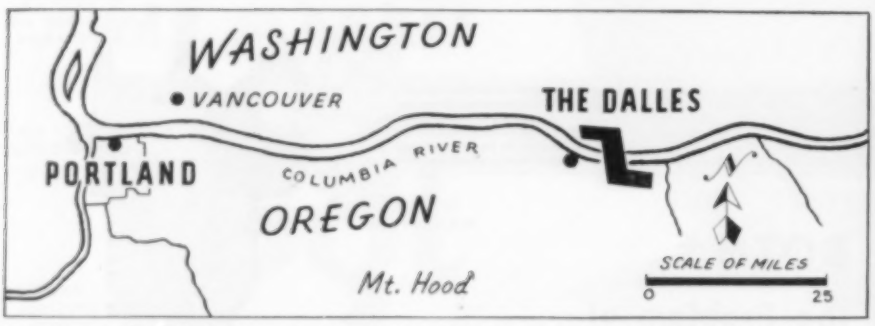
SEND FOR BULLETIN 177 TO:

R. P. ADAMS CO., INC. 209 EAST PARK DRIVE BUFFALO 17, N. Y.

Circle 33A on reply card



The dust flies as this large battery of wagon drills goes into action, clearing the way for S-shaped, 8500-ft The Dalles Dam, located on Columbia River, east of Portland, Oregon.



This map shows approximate location of 8500-ft The Dalles Dam on Columbia River.

Irving Rauw, owner, Westland Equipment Co., supplier of the Bethlehem hollow drill steel.

Clearing the way for The Dalles Dam on Columbia River

To further the development of the great Northwest, a gigantic new dam, called The Dalles, is taking shape near the city of that name on the Columbia River, east of Portland, Oregon. The new structure, built for navigation and power purposes, is part of the Federal Columbia River Power System of multiple-purpose dams. It is being constructed by the Portland District, Corps of Engineers, U. S. Army.

The Dalles Dam is an S-shaped structure, 115 ft above normal tailwater elevation, and 8500 ft long. Upon completion, it will impound 317,000 acre-feet of water, and the power house will produce 1,746,000 kw of ultimate power.

One of the early contracts for the huge dam was awarded to Atkinson Ostrander Company, San Francisco, Calif. It called for the construction of the concrete spillway dam, including spillway tainter gates, and excavation for the tailrace and approach channel.

One of the initial tasks facing Atkinson Ostrander was the removal of approximately 2,160,000 cu yd of Columbia River basalt, a dense, grayish-black igneous rock. The contractors drilled blast holes ranging from 18 ft to 24 ft deep, using wagon drills equipped with Bethlehem hollow drill steel, and fitted in most cases with carbide-insert bits.

As has been the case in so many of the country's important construction projects, Bethlehem Hollow Drill Steel gave good, dependable service, and was instrumental in keeping this portion of the job on schedule.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Two Grades of

BETHLEHEM HOLLOW DRILL STEEL

CARBON · ULTRA-ALLOY (chrome moly)

BETHLEHEM STEEL

The Quarrymaster, because of its air operated treads, is highly maneuverable. It takes only a matter of a few minutes to move from one hole to the next. Shown above is a unit at the Fanwood Crushed Stone and Quarry Co., Fanwood, N. J.

How Nickel Alloy Steels help Quarrymaster cut costs

Packing its own power of two 415-cfm heavy-duty air compressors, the self-propelled Ingersoll-Rand Quarrymaster cuts costs and speeds up many heavy rock excavation jobs by being able to drill 6″ diameter holes up to 75 feet deep and space them on much greater centers than conventional drills.

The heart of the unit is a remarkable compressed air operated piston rock drill. The piston itself, the rifle bar and other vital parts are made from heat-treated nickel alloy steels engineered to meet the demands of each component.

For instance, the nickel alloy steel piston is able to withstand the continuous load of more than 200 heavy blows per minute.

In a similar way, other nickel alloy steels answer the particular needs of the other parts. As a result, this tool can drill a 6″ hole in the hardest rock at the rate of 10 feet per hour. In softer rock, it can drill up to 80 feet per hour.

Whatever the job, when you need a metal with extra qualities for dependable performance, less maintenance and fewer replacements, think of nickel alloyed steels.

Send us details of your metal problems... we'll be glad to help you with suggestions for specific applications.

The Ingersoll-Rand Carset drill bits used on the machines are carried by high strength alloy steel rods which withstand the severe shocks and stresses encountered in pit, quarry and construction work.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

When you want help in a hurry—

CALL YOUR HANSEN REPRESENTATIVE

CHARLES WEBER, JR.
Charles Weber Co., Louisville, Ky.
Offers engineering help on fluid line installations and accessory equipment to firms in rapidly growing industrial areas of Kentucky, Tennessee and Arkansas.

CLEM W. WESTON
Clem W. Weston, New Orleans, La.
Provides industrial plants in Louisiana and Mississippi with practical know-how and assistance on pneumatic and hydraulic problems — including fluid line circuits for original equipment applications.

REPRESENTATIVES

BALTIMORE	DETROIT	NEWARK
BIRMINGHAM	FT. WAYNE	NEW ORLEANS
BUFFALO	HARTFORD	PHILADELPHIA
CHICAGO	KANSAS CITY	PITTSBURGH
CLEVELAND	LOS ANGELES	SAN FRANCISCO
DALLAS	LOUISVILLE	SAVANNAH
DAYTON	MILWAUKEE	SEATTLE
DENVER	MINNEAPOLIS	ST. LOUIS

MONTREAL • TORONTO • VANCOUVER
Export Department: Cleveland

Quick-Connective Couplings are his business

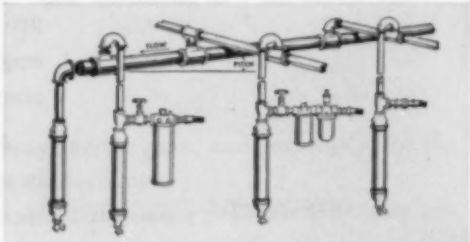
—but so are Fluid Line Problems

In thousands of plants throughout the nation, it's almost standard practice to call the Hansen representative—either when actual fluid line troubles arise—or when hook-ups are being planned or altered.

The main job of the Hansen representative, of course, is to supply you with exactly the right couplings specifically designed and constructed for the requirements of your particular application.

But from years of on-the-job experience with almost every type of fluid line installation, he can also give you real help on such matters as the pitch of your lines, proper take-off, location of drains and other details which insure a moisture-free circuit operating at maximum efficiency.

To keep moisture out of air operated devices—
ASK THE HANSEN REPRESENTATIVE ABOUT THE HANSEN HOOK-UP



QUICK-CONNECTIVE FLUID LINE COUPLINGS

1. QUICK CONNECTION AND DISCONNECTION **2.** INSTANT AUTOMATIC FLOW OR SHUT-OFF

One-Way Shut-Off

Two-Way Shut-Off

ALSO STRAIGHT-THROUGH QUICK-CONNECTIVE COUPLINGS
Send for Catalog!

THE HANSEN MANUFACTURING COMPANY
4031 WEST 150th STREET • CLEVELAND 11, OHIO

Circle 36A on reply card

SWITCH TO GM DIESEL

Ingersoll-Rand Gyro-Flo 600, driven by GM 6-71 Diesel, powers two wagon drills in New Jersey quarry.

FOR PORTABLE AIR POWER AT LOWER COST

CONTRACTORS, utilities, mine and quarry operators who have switched to General Motors Diesel-powered Gyro-Flo compressors unanimously report they get "*more work done faster at lower cost!*"

Basic reason is that this modern rotary compressor takes full advantage of GM Diesel's higher-speed 2-cycle operation. Because it delivers power at *every* downstroke of every piston, not every *other* downstroke as do 4-cycle Diesels, the GM Diesel produces a smoother, steadier flow of power. And this means full-rated delivery of even-flowing, non-pulsating cooler air at 100 psi and better.

The GM Diesel starts quickly in any weather and maintains its rated power well at high altitudes. Two-cycle design makes it smaller and lighter for its power. This permits lighter, more compact equipment with all the advantages of greater mobility.

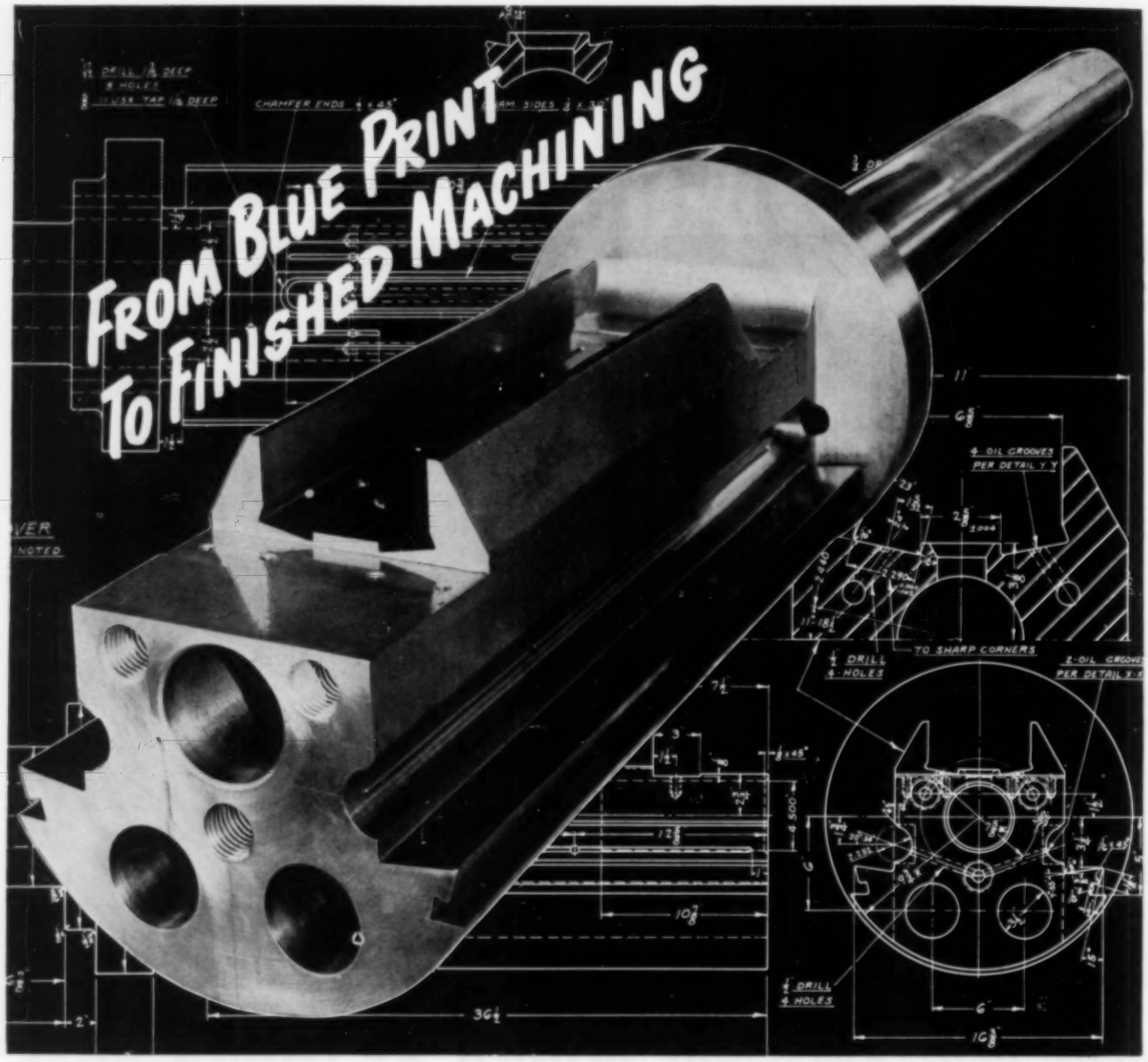
Add to these features interchangeability of low-cost parts, plus world-wide General Motors Diesel service facilities, and you have reasons why it pays to standardize on GM Diesel power in all your equipment. Available today in all four sizes of Ingersoll-Rand Gyro-Flo compressors—105, 210, 315 and 600 cfm—and in more than 750 models of other equipment built by over 150 different manufacturers. *Save money—specify GM Diesel!*

Single Engines...16 to 275 H.P. Multiple Units...Up to 840 H.P.

GM GENERAL MOTORS DIESEL POWER

DETROIT DIESEL
ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN

Circle 27A on reply card



This Block Body for a Tension Reel represents the coordinated effort of many National Forge skills in turning out the required electric alloy steel, the proper heat treating and the intricate machining to exacting tolerances.

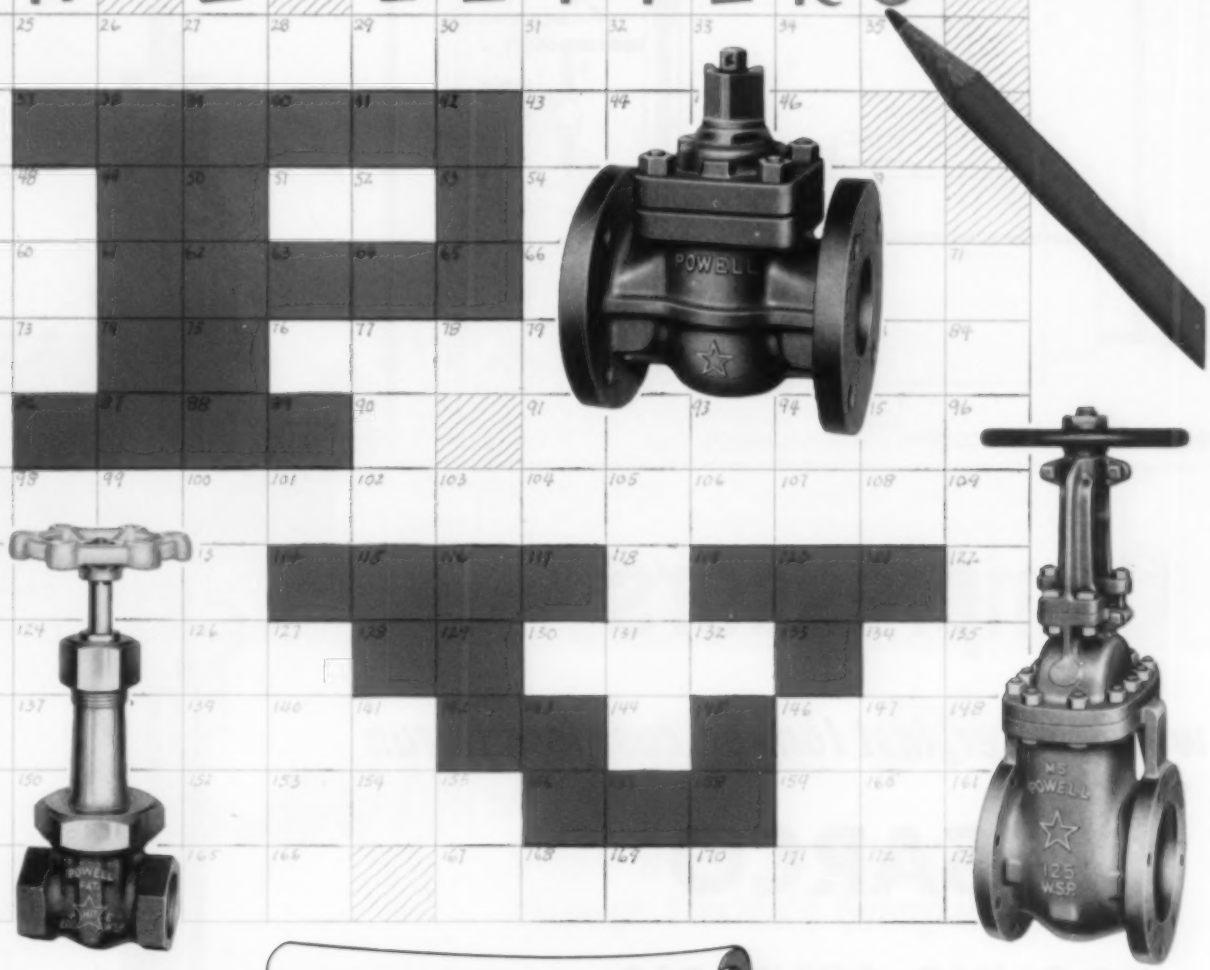
National Forge offers you complete forging service in one plant—under one responsibility.

Why not take advantage of this "all-in-one" service the next time you need forgings?

For full information, write NATIONAL FORGE AND ORDNANCE COMPANY, Irvine, Warren County, Pennsylvania.

Circle 38A on reply card

DEPENDABILITY IN 2 LETTERS



TOP

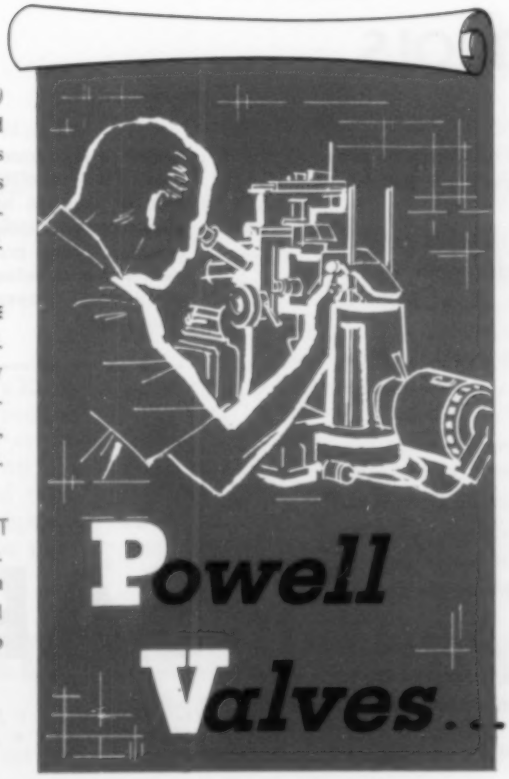
LUBRICATED PLUG VALVE *(Fig. 2201)* Flanged end. Available with screwed or bolted glands. Semi-Steel valves available for 175 and 200 pounds W.O.G. Carbon Steel Valves available for 150 and 300 pounds W.P.

LEFT

BRONZE "WHITE STAR" GATE VALVE *(Fig. 375)* For 200 pounds W.S.P. Union bonnet with inside screw rising stem. Renewable "Powellium" Nickel-Bronze wedge. Sizes, ¼" to ¾", Solid Wedge; 1" to 3". Double Wedge.

RIGHT

"MODEL STAR" GATE VALVE *(Fig. 1793)* For 125 pounds W.P. Iron body, bronze mounted. Supplied with taper solid wedge. Sizes 2" to 30", inclusive.



The life of a valve bears a certain relation to the life of the company that produces it. Powell has had a solid, oak-like growth for over a hundred years. That's only possible because The William Powell Company makes dependable valves.

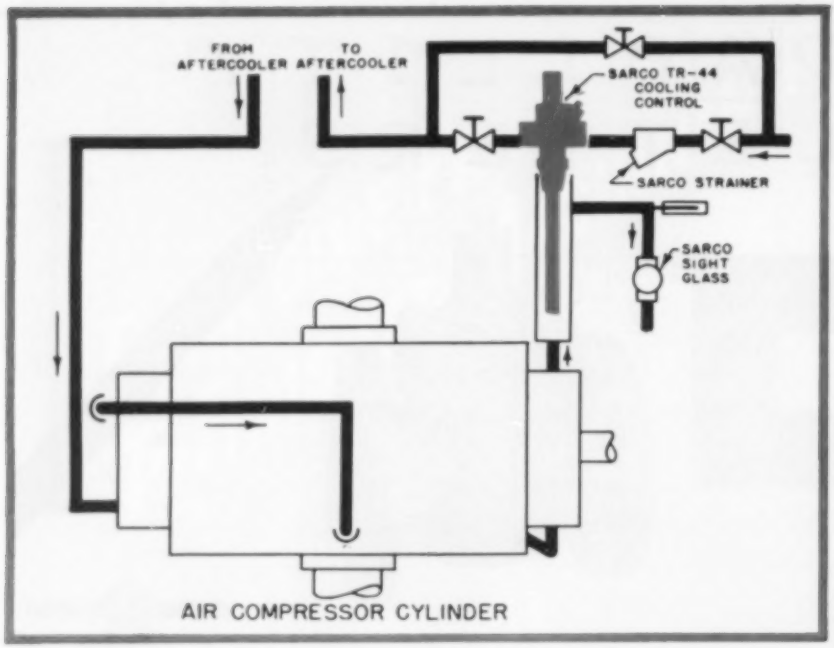
Today, Powell Valves are proving their dependability in a greater variety of installations than any other valves in the world. And Powell is very likely the leader in research as well as development of special valves to overcome flow control problem situations.

All good reasons why PV, for Powell Valves, appears on more specifications year after year.

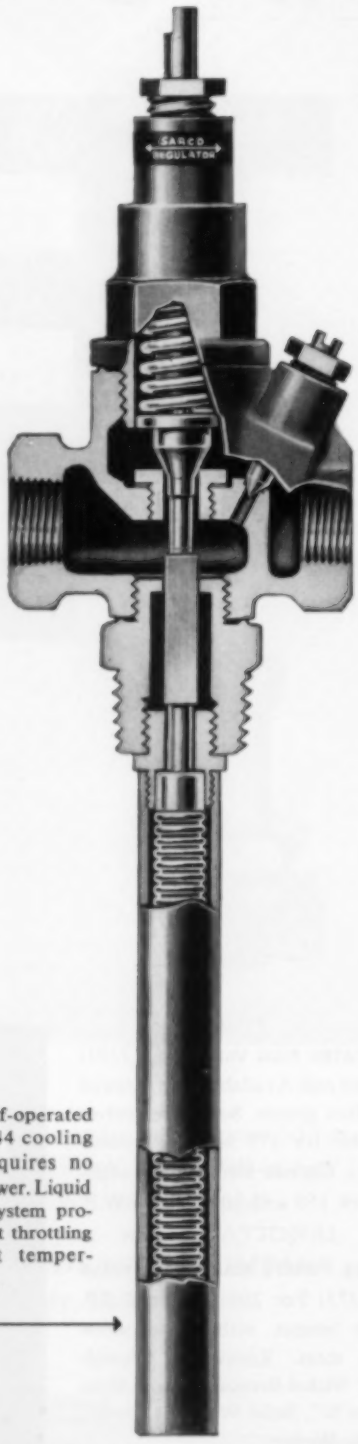
THE WILLIAM POWELL COMPANY
CINCINNATI 22, OHIO

CONTROLS FOR THE LIFE LINES OF INDUSTRY

Circle 39A on reply card



Sarco Cooling Control guards against dangerous over and under cooling.



Compressors

work better, last longer, cost less to run

with SARCO

COOLING CONTROLS

YOU have to keep your eye on a lot of things to get top efficiency from compressed air systems – and one of the most important is *cooling*.

For example, overcooling – usually a result of manual control – causes condensation on cylinder walls which destroys lubricant and increases wear. In addition, it wastes water.

If you're undercooling, you're cutting down on compressor capacity – and you're taking chances of damaging cylinders, pistons, valves and seats.

It's a lot easier – and also safer and more economical – to let dependable Sarco self-operated temperature controls take over. They insure optimum cooling effect with minimum water consumption regardless of load variation, changes in pressure and temperature of water supply. *You get protection for compressors with maximum efficiency at minimum cost.*

Send for Bulletin No. 520-A "Is Your Air Compressor Capacity Effective?" Sarco Company, Inc., Empire State Building, New York 1, N. Y. Representatives in principal cities.

Simple, self-operated Sarco TR-44 cooling control requires no auxiliary power. Liquid expansion system provides perfect throttling throughout temperature range.

SARCO

COOLING CONTROLS • DRAIN TRAPS • STRAINERS
THERMOSTATS • PRESSURE SWITCHES

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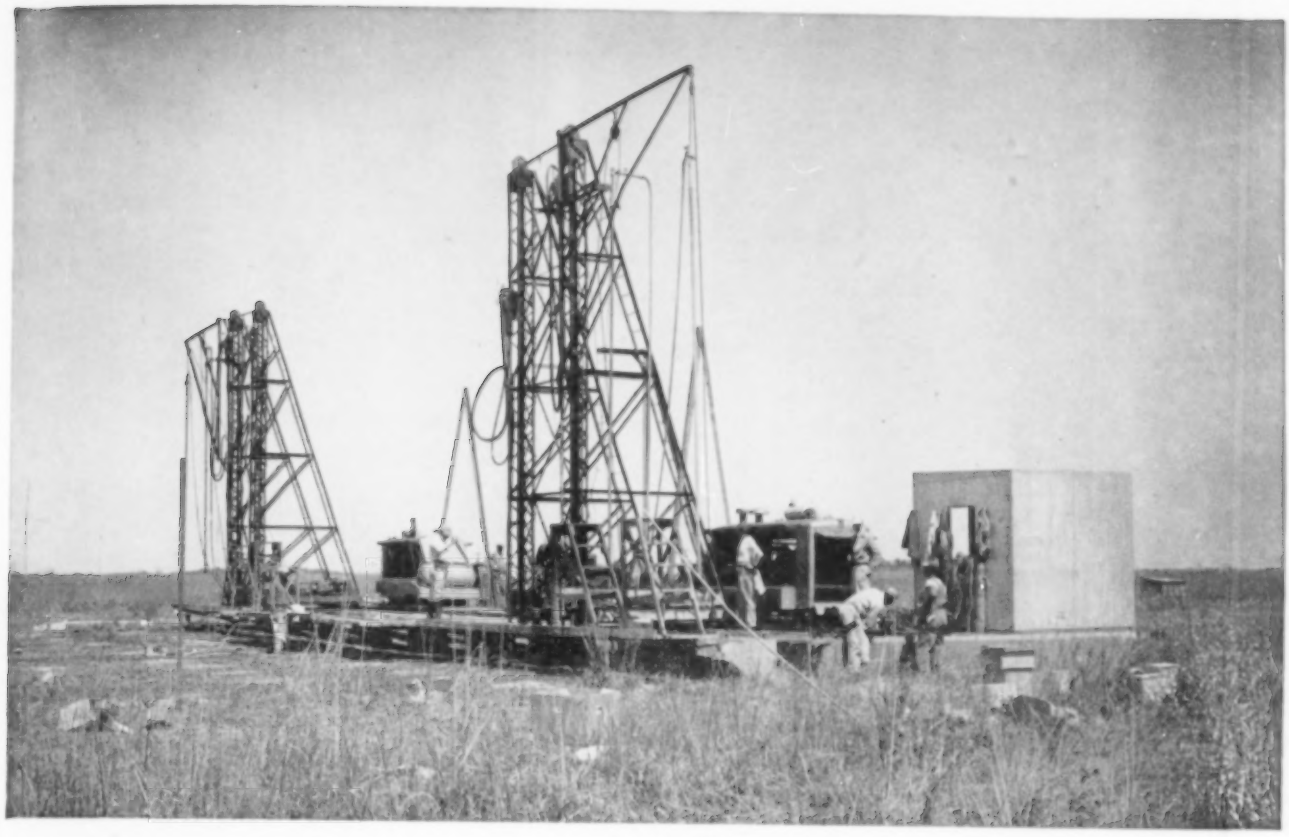


LAND-GOING DRILL BOAT

Helps Blast 16-Mile Canal through Florida's Everglades

Amphibious barge readily towed through water or overland, carries four I-R famous X71WD Drills powered by two I-R Gyro-Flo Compressors

Deep in the heart of Florida's Everglades, the Gahagan Construction Corporation of New York is engaged in drilling and blasting 2½ million cubic yards of coral rock. The rock lies in 16 miles of proposed drainage canals across the peat and semi-fluid waste land of the Everglades.

The contract covers part of a huge flood control and water conservation project that will consist of a series of levees and borrow pit drainage canals dividing the district into vast protected areas. An artificial lake 1500 square miles in area will be created which will be used to store excess flood waters until needed for irrigation and restoration of water levels during dry periods.

To drill 11 of the 16 miles of 90 foot canal under existing conditions required radical innovations in rock drilling equipment. A special all aluminum amphibious drill barge that can be towed through water and pulled overland was designed by Gahagan Construction Corporation to carry the compressors and drilling towers. The work is under the control of Jacksonville, Fla. District of the Corps of Engineers, U. S. Army.

Four Ingersoll-Rand X71-WD Drills were selected to do the drilling because of their high drilling speed and hole cleaning ability especially on deep holes. Two Ingersoll-Rand Gyro-Flo 600 cfm rotary compressors were chosen because of their light weight and ability to deliver high pressure air at full load.

Ingersoll-Rand makes a full line of contracting equipment. Ask about the I-R Contractors Combination.

947-5

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS • ROCK DRILLS • AIR TOOLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES

Circle 41A on reply card

Provides vacuum for making lamp bulbs

. . . with help of TIMKEN® bearings

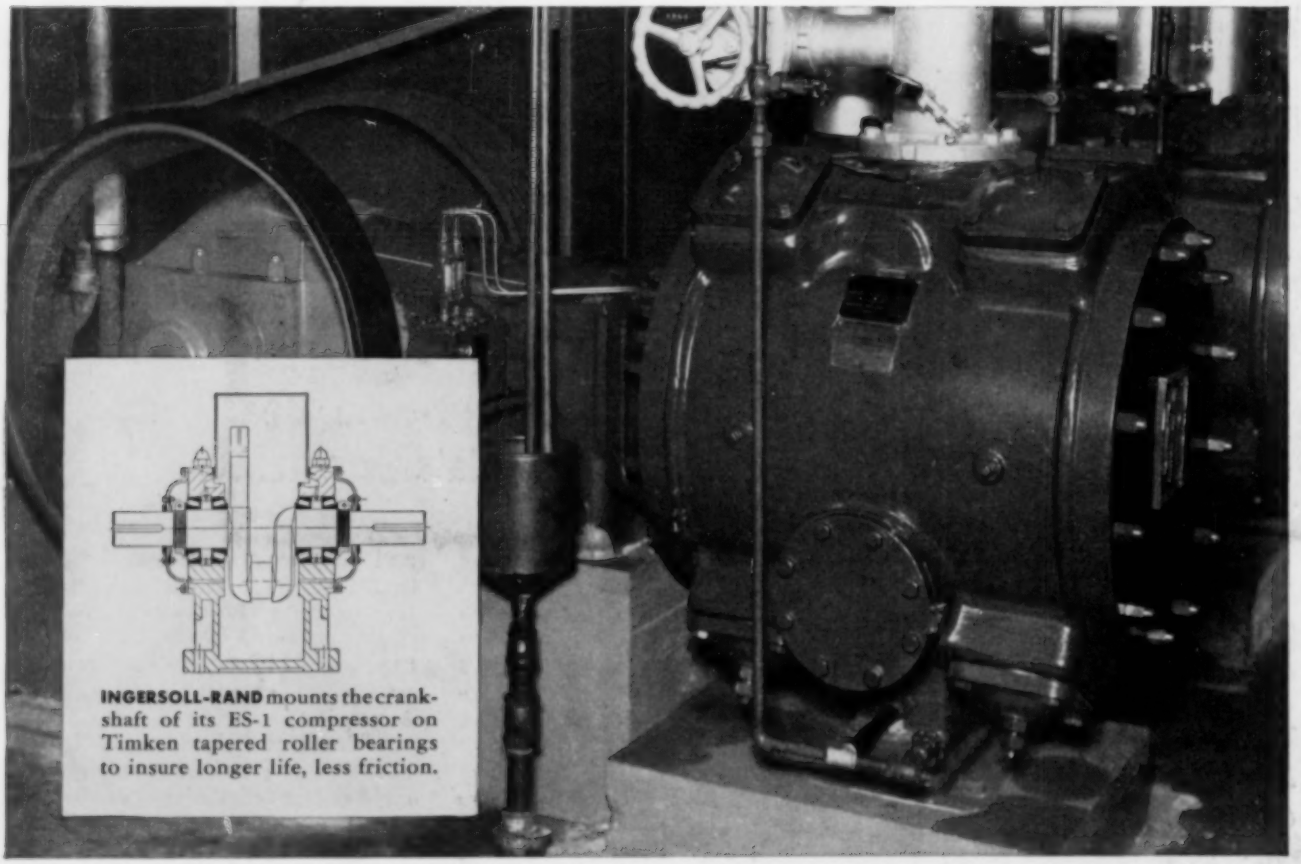
PICTURED below is one of two Ingersoll-Rand ES-1 compressors used as single-stage vacuum pumps in a modern lamp factory. They provide a 26″ mercury vacuum for evacuating lamp bulbs. And since any compressor failure would slow production to a walk, every precaution is taken to prevent breakdowns and keep maintenance delays to a minimum. One important way these compressors are kept on the go: crankshafts are mounted on Timken® tapered roller bearings.

The tapered design of Timken bearings lets them take both radial and thrust loads, holds crankshaft in positive alignment. Result: wear on adjacent parts is reduced. Crankshaft wear is eliminated because there is no friction between it and the bearing. And friction within the bearing is practically eliminated due to the true rolling motion and incredibly smooth surface finish of Timken bearings.

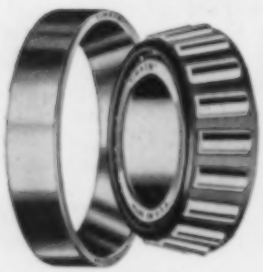
Timken bearings hold housings and shafts concentric, making closures more effective. Dirt and moisture are kept out—lubricant is kept in. Lubrication and maintenance costs are held to a minimum.

Be sure to specify Timken bearings for the machinery you build or buy. Look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



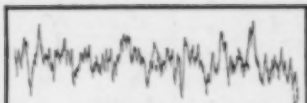
INGERSOLL-RAND mounts the crankshaft of its ES-1 compressor on Timken tapered roller bearings to insure longer life, less friction.



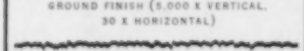
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

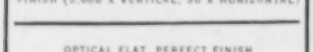
TAPERED ROLLER BEARINGS



PROFILOGRAPH TRACE. GOOD COMMERCIALLY GROUND FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)



PROFILOGRAPH TRACE. TIMKEN BEARING FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)



OPTICAL FLAT. PERFECT FINISH

SMOOTH TO MILLIONTHS OF AN INCH

Surface finish of high quality Timken bearing rollers and races is so smooth that it takes a profilograph to measure its smoothness. This instrument measures surface variations to a millionth of an inch, as shown at the left.

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

Circle 42A on reply card